DOCTORAL DISSERTATIONS SUBMITTED IN THE DEPARTMENT OF CHEMISTRY, ALIGARH MUSLIM UNIVERSITY, ALIGARH FROM 1997-1998 : A CITATION STUDY

DISSERTATION

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
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Master of Library & Information Science

By

Zeba Zarrin

Roll No. 420
Enrol No. CC-5771

Under the Supervision of

Mr. M. Masoom Raza
(LECTURER)

DEPARTMENT OF LIBRARY & INFORMATION SCIENCE
ALIGARH MUSLIM UNIVERSITY
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CERTIFICATE

This is to certify that ***Miss Zeba Zarrin*** has completed her dissertation entitled " ***Doctoral dissertations submitted in the Department of Chemistry, Aligarh Muslim University, Aligarh from 1997-1998: A citation study***" in partial fulfilment of the requirements for the degree of ***Master of Library and Information Science***. She has conducted the work under my supervision and guidance. I deem it fit for submission.

Masoom Raza

(M. Masoom Raza)

Dedicated

to my

Heartiest Parents

Acknowledgement

It is indeed a matter of immense satisfaction for me to complete my dissertation work by the grace of Almighty "ALLAH" who has created this universe and inculcated the immature minds with knowledge. Thanks to "His" blessings for providing me the talent to complete my assignment.

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Zeba Zarrin

Zeba Zarrin

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INTRODUCTION

1.1 ALIGARH MUSLIM UNIVERSITY

Sir Syed Ahmad Khan, one of the architects of modern India was born on October 17, 1817 in Delhi.

Sir Syed Ahmad Khan was highly impressed by the culture and customs of western society. He instituted Scientific Society in 1864 to create a scientific temperament among the Muslims and available to Indians in their own language. He thus rose to establish the Mohammmedan Anglo-Oriental College at Aligarh and than he established Mohammaden Anglo Oriented College (MAO).in 1875 which is one of the most important events in the educational and social history of modern India. It was an important catalyst in a process of social change among Muslims. In 1920, an Act of Indian Legislative Council elevated the MAO College to the status of a central university. Since that time AMU has grown into a major Indian University It presently covers a very wise spectrum of academic disciplines, having 88 departments and 5 institution, divided into 12 faculties namely Agriculture, Arts, Commerce, Engineering & Technology, Law, Life Sciences, Medicine, Management, Science, Social Science, Theology and Unani Medicine. Besides these there are 13 cengtres namely centre of professional courses, Biotechnology unit and schools. In the original scheme of M.A.O. College there was no provision for women education but there was so much demand for it that in 1942 the Muslim Girl" School was raised to full fledged degree college for women. Since the adoption of act of 1951, which empowered the university to make special arrangements in respect of residence, discipline and teaching of women students, the college was taken over by the university and is now one of the several institutions maintained by it.

The university currently has about 28000 students on its rolls, most of whom stay in 16 halls of residences with 70 hostels. It employees about 1400

academic staff, and about 6000 non-teaching staff. On an average, about 500 foreign students come to study at A.M.U. every year. The University has a campus spread over 467.6 heacares of land. Aligarh Muslim University not only provides modern learning but also grooms the personality of students. The prevalent traditions of the university help us to live better in this world. Aligarh Muslim University has given extra ordinary personalities in every field. The list includes Artists, Poets, Politicians, Doctors, Scientists, Academicians who reached the zenith in their profession.

Aligarh Muslim University has also the honour of being the largest residential University in India.

1.2 DEPARTMENT OF CHEMISTRY

The Department of Chemistry is a well established department of the Aligarh Muslim University with its long traditions of high quality research and teaching. The M.Sc. classes were started under the stewardship of Prof. H.B.Duncliffe. The department was subsequently guided by Mr. Allah Bux, Col. M. Haider Khan, Prof. H.B. Krall and Dr. Qasim Ali Mansoori till 1929. The foundation stone of the present building was laid by Prince Hamidullah Khan of Bhopal in 1926. The research is Organic Chemistry was started in the department by Prof. R.F. Hunder and Dr. R.D. Desai. In 1934 the first Ph.D. degree of the Department was awarded to Dr. M. Omar Farooq.

Prof. A.R.Kidwai was appointed in 1951, who organised the post graduate teaching and research programme in Biochemistry and also established a research unit in Unani Medicines at Ajmal Khan Tibbiya College of this University. During the tenure of Prof. Kidwai, a new section of Analytical Chemistry, with Prof. Mohsin Qureshi as its incharge, was started. The section of Inorganic Chemistry initiated its research activity under the patronage of Prof. S.M. Fazlur Rehman.

The Department of Chemistry is one of the biggest Departments in the faculty of Science. Chemistry is the compulsory subject for all students of science in undergraduate classes irrespective of the main subject offered by the student. Thus about one third of the total teaching load of the Science Faculty is borne by the Department of Chemistry alone. In addition to catering to the academic requirements for teaching undergraduate and post graduate students the faculty members of this Department also been actively engaged in research in all the four areas of specialization viz., Analytical Chemistry, Inorganic Chemistry, Organic Chemistry and Physical Chemistry. They have also been supervising the M.Phil and Ph.D. candidates.

1.2.1 SEMINAR LIBRARY

Chemistry Seminar library is our pride possession and it is considered as one of the valuable chemistry libraries of the nation. At present the library has precious collection of about 20,000 books and bound periodicals some of which are very rare and not available in the publication market. For example, Chemical Abstract is available from 1907 till date and most of the important journals of chemistry are available since the time of their publication. These valuable collections of books and journals have made the seminar library very popular among the teachers and research scholars of the university.

The users of the library include scientists, faculty members, student of B.Sc. and M.Sc. and research scholars. Total number of the user is about 250 per day. The library facilities are also availed by other Departments of the university, namely Medical College, Biochemistry, Biotechnology, Applied Chemistry, Chemical Engineering and institute of Agricultural Research. Besides this, the chemistry library also caters to the needs of the local colleges and adjoining districts of Aligarh.

1.2.2 RESEARCH (M. Phil/Ph.D.)

M.Phil courses were introduced in the department with a view to prepare students for taking up teaching assignments with a level of knowledge higher than those having only M.Sc. degree and to initiate and train them into research methodology so that if they had facility in their colleges they could continue research programmes while maintaining their contacts with supervisors and receiving support in the matter of instrumentation, library facilities etc. Supervisors have made it compulsory for the M.Phil students to study some relevant current general topics, research methodology, bibliography, literature search and gain a thorough knowledge of the specified research topic and its allied areas. It is only through the commitment and enthusiasm of teachers that students have been conducting the M.Phil teaching without any commensurate increase in the strength of the teaching staff with the result that the faculty is greatly overburden with extra work load.

Aligarh city is surrounded by neighbouring district like, Agra, Bulandshahar, Mainpuri, Meerut, Moradabad, Barailly, Shahjahanpur which have many constituent colleges of Meerut, Rohilkhand and Agra Universities. The department has generously provided support by way of access to its library, seminar, research, journals, analytical facilities and instrumentation support to all those research workers who comes for help. Thus it has a pivotal position in the area for its leadership role in teachers training for research. The Department also attracts students from all the above mentioned catchment areas for undergraduate and postgraduate education and for research.

1.2.3 RESEARCH ACTIVITIES

Inorganic Chemistry section is one of the four major sections of the Department. It caters the responsibility of research and teaching the same quantum of syllabus and numbers of students as the other branches. The broad areas of research currently being tackled by a handle of faculty members are given below:

1.2.3.1 Coordination Chemistry

1.2.3.2 Non-aqueous Solvent System

1.2.3.3 Macrocyclic Compounds

1.2.3.4 Bioinorganic Chemistry

1.2.3.5 Synthesis of Bimetallic Compounds

1.2.3.6 Organylborate Chemistry

1.2.3.1 Coordination Chemistry

A field which, in its broadest usage, is acid-base chemistry as defined by G.N. Lewis. However, the term coordination chemistry is generally used to describe the chemistry of metals and metal ions in their interactions with other molecules or ions. For example, reactions (1)-(3) show acid-base type

$$Mg^2 + 6H_2O \rightarrow \quad Mg(H_2O)_6^{2+} \qquad (1)$$

$$Ni + 4CO \rightarrow \quad Ni(CO)_4 \qquad (2)$$

$$Fe^{2+} + 6CN^- \rightarrow \quad Fe(CN)_6^{4-} \qquad (3)$$

Reactions, the products formed are coordination ions or compounds, and this area of chemistry is known as coordination chemistry.

Thus, it follows that coordination compounds are compounds that contain a central atom or ion and a group of ions or molecules surrounding it. Such a compound tends to retain its identity, even in solution, although partial dissociation may occur. The charge on the coordinated species may be positive, zero, or negative depending on the charges carried by the central atom and the coordinated groups. These groups are called ligands, and the total number of attachments to the central atom is called the coordination number. Other names commonly used for these compounds include complex compounds, complex ions, Werner complexes, coordinated complexes, chelate compounds or simply complexes.

Experimental observations as early as the middle of the eighteenth century reported the isolation of coordination compounds. During that time and

for the following 150 years, the valence theory could not adequately account for such materials.

1.2.3.2. Nonaqueous Solvent

The classification, often arbitrary, of nonaqueous solvents can be made on the basis of a variety of factors. Excluding utilitarian considerations and classifications based on chemical character, that is, the presence of distinctive groups such as carbonyl in the molecule, useful classification schemes involving nonaqueous solvents inevitably involve considerations of acid-base phenomena. Of the two major theories, the Bronsted-Lowry protonic concept has been the most useful because the early solvents of interest were invariably potential proton donors. However, the Lewis theory of acidity has become very useful for understanding solution phenomena in aprotic systems such as sulfur dioxide (SO_2).

The ability of a solvent to form a so-called onium species is an important factor in defining the nature of the solution phenomena it will support. Onium species can be formed by reaction with a potential proton donor or by self-ionization of the solvent. Four classes of solvents are generally recognized according to their ability to coordinate with the proton-basic, acidic, aprotic, and amphiprotic solvents.

1.2.3.3 Macrocyclic Compound

An organic compound that contains a large ring. In the organic chemistry of alicyclic compounds, a closed chain of 12 carbon (C) atoms is usually regarded as the minimum size for a large ring; crown ethers are similarly defined. Macrocyclic compounds may be a single, continuous thread of atoms, as a cyclododecane [$(CH_2)_{12}$] or they may incorporate more than one strand or other ring systems (subcyclic units) within the macrocycle or macroring. In addition, macrocycles may be composed of aromatic rings that

confer considerable rigidity upon the cyclic system. These aromatic rings may be joined together or coupled by spacer units consisting of one or more carbon atoms. The compounds generally thought of as macrocycles include crown ethers, cryptands, spherands, carcerands, cyclodextrins, cyclophanes and calixarenes.

1.2.3.4 Bioinorganic Chemistry

The borderline field between biochemistry and inorganic chemistry; also known as inorganic biochemistry or metallobiochemistry. This field in general involves the application of the principles of inorganic chemistry to problems of biology and biochemistry. Because most biological components are organic by nature, that is, they involve the chemistry of carbon compounds, the combination of the prefix bio- and inorganic may appear contradictory. However, it is well known that organisms require a number of other elements to carry out their basic functions. Many of these elements are present as metal ions that are involved in crucial biological processes such as respiration, metabolism, cell division, muscle contraction, nerve impulse transmission, and gene regulation. The characterization of the interactions between such metal centres and biological components is the heart of bioinorganic chemistry.

The research in organic Chemistry was initiated in early thirtees by Prof. R. F. Hunter and Prof. R. D. Desai and research works from this Department were published in nature and other leading journals. The main trust in organic research have been in the areas of Natural Product Chemistry and Synthetic Organic Chemistry.

Physical Chemistry section of the Department has a long and rich research tradition. Each member of the section is actively involved in one or more research projects. The areas of major research interest of the section are as under:

1.2.3.8 Solid state Chemistry

1.2.3.9 Kinetics and Mechanism

1.2.3.10 Chemical Dynamics and Biomoleculles

1.2.3.11 Conducting Polymers

1.2.3.12 Membrane Phenomenoa

1.2.3.13 Synthetic Oxygen carriers

1.2.3.7 Electrochemistry

The science dealing with the chemical charges accompanying the passage of an electronic current the reverse process in which a chemical reaction is used as the source of energy to produce an electric current, as in a battery, electronic conduction occurs through the motion of charged particles. The charged particles may be electrons or ions, which are electrically charged atoms, molecules, or moleculars aggregates. Ionic conduction in electrolytes, (Motten salts, and certain ionically conductive solids) is a phase of electrochemistry.

1.2.3.8 Solid-State Chemistry

The elements and compounds that form the subject matter of inorganic chemistry exhibit a very wide range of physical properties which run the gamut from helium, the substance of lowest known melting and boiling point, to elements such as tungsten, titanium, and carbon, which are among the most refractory high-melting substances known. The study of solid-state reactions and compounds that can be prepared by them has assumed great importance, and is another major research area in inorganic chemistry. Unlike gaseous compounds and most organic compounds, which obey the law of definite proportions, may solid compounds, particularly those of the transition elements, exhibit variability of composition, or as it is frequently designated,

nonstoichiometry. When a solid compound deviates from simple stoichiometric relations, it contains an excess of either positively charged metal cations or negatively charged anions. Such solid systems frequently show unusual electronic properties, which are made use of in many solid-state devices. Photovoltaic cells, for example, which convert light to electricity, belong to this group of nonstoichiometric solid-state devices.

Transistors, thermistors, phosphors, and lightemitting diodes are also important solid-state devices. Because these materials are frequently prepared by solid-phase reactions, high temperatures may be required for the reaction. High-temperature chemistry has greatly expanded in scope, not only in the preparation of nonstoichiometric compounds, but also in the preparation of refractories useful at very high temperatures in space and nuclear technology. Although many reactions can be forced to proceed in the desired direction by only increasing the temperature, this is not always adequate in all instances. Another dimension in solid-state chemistry was added by the simultaneous use of high temperature and extremely high pressures. With the equipment available, it is possible to carry out solid-state reactions at temperatures of approximately 2500°C (4532°F) and pressures of the order 10^5 millipascals (10^6 bars). Under conditions of high temperature and pressure, ordinary carbon (graphite) can be converted into diamond, and since the pressure is actually sufficient to distort the electron orbitals, new varieties of matter can be prepared. For example, liquid hydrogen has been converted to a metallic form at these ultrahigh pressure.

1.2.3.9 Kinetics and Mechanisms:

Organic reactions generally proceed with the skeleton of the molecule remaining intact. Inorganic gas-phase reactions, on the contrary, are usually characterized by a complete disruption of molecular structure followed by reorganization to form the products of the reaction. Gas-phase reactions of

inorganic compounds are thus in principle more complicated than are the usual organic reactions. Electron transfer in the oxidation-reduction reactions of transition-metal ions and compounds in solution has been a particularly important topic of theoretical interest. As is the case with electron transfer reactions in general, the role of electron tunneling in inorganic redox reactions still has many obscure features. This is particularly true of the very complex redox reactions of the actinide elements. Hydrolytic reactions of highly charged ions in aqueous solutions are also important in the mechanisms of many inorganic reactions and are important aspects of modern transition-element and actinide element chemistry. These subjects have become the concern of physical and theoretical chemists, but they also continue to be an important part of contemporary inorganic chemistry.

All the research groups have made significant contribution, both in terms of quality. The section of Analytical Chemistry though relatively newer, has made significant contribution to the departmental research activities.

1.3 CHEMISTRY

Chemistry is a branch of science which embraces the properties, composition, structure of matter, the changes in structure and composition that matter undergoes, and the accompanying energy changes. It is important to distinguish chemical change, implicit in this definition and changes in physical form. An example of the latter is the conversion of liquid water to solid or gas by cooling or heating; the water substance is unchanged. In chemical change, such as the rusting of iron, the metal is consumed as it reacts with air in the presence of water to form the new substance, iron oxide. The objectives of the chemist is to aid in the interpretation of the universe. Much progress has been made toward meeting this objective because not only has the structure and composition of many of the materials on the earth been elucidated, but also those of planets, the satellites, the stars, and the materials of interstellar space.

1.3.1 Fundamentals of chemistry

Anything that occupies space and has mass, or weight, is called matter. Matter can exist in any one of three physical states: solid, liquid, or gaseous.

Matter undergoes changes which may be either chemical changes or physical changes. When water is transformed into steam it still retains all the chemical properties of water; that is, only its physical state is changed. Upon cooling, it returns to its original liquid state. However, when a piece of wood is burned, the original substance disappears, and new substances are formed. This is a chemical change, the kind of change with which chemistry is primarily concerned.

Elements

Chemists think that all matter is made up of fundamental substances called elements. An element cannot be broken down or decomposed by ordinary chemical means. The smallest part of an element that can take part in chemical reactions is the atom. The chemical properties of an element are really the properties of its atoms. Chemists try to understand the structure of the atom and hence to interpret its ability to react.

Modern theories claim that all atoms of one element have the same chemical properties. Two or more atoms of one element which differ slightly in weight are called isotopes. An atom has a nucleus made up of positively charged protons and uncharged neutrons. The "atom smashing" machines of physics or the reactions of an atomic bomb can change this nucleus. Outside the nucleus the atom contains electrons, which may be thought of as roving about the nucleus much as the planets rove about the sun. Chemical reactions between atoms involve these electrons but cannot change the arrangement of the protons and neutrons in the nucleus.

The elements are classified into two general categories: metals and nonmetals. However, since some elements have properties of both classes, there is no sharp dividing line between the two groups. The metals are

characterized by such physical properties as luster; high conductivity of heat and electricity; and high tensile strength, malleability; and ductility (that is, they may be hammered or rolled into sheets or drawn into wire). All the nonmetals but one are either brittle solids or gases at ordinary temperatures. The exception is bromine, a liquid. The solid nonmetals have lower tensile strength and are poorer conductors than metals.

There are, two distinctive characteristics that determine the chemical "personality" of the atoms of an element: (1) atomic number, and (2) atomic weight.

Atomic Number

The positive charge on the nucleus is its atomic number. This is the number of protons in the nucleus and, since the whole atom is neutral it also is the number of electrons an atom holds the same atomic number. The range of atomic numbers is from 1 (for hydrogen) to more than 100.

Chemical Elements

Elements	Atomic No.	Symbol	Atomic Weight
Actinium	89	Ac	[227]
Aluminum	13	Al	26.9815
Americium	95	Am	[243]
Antimony	51	Sb	121.7
Argon	18	Ar	39.95
Arsenic	33	As	74.9216
Astatine	85	At	[210]
Barium	56	Ba	137.3
Berkelium	97	Bk	[247]
Beryllium	4	Be	9.01218
Bismuth	83	Bi	208.9806

Boron	5	B	10.81
Bromine	35	Br	79.904
Cadmium	48	Cd	112.40
Calcium	20	Ca	40.08
Californium	98	Cf	[251]
Carbon	6	C	12.011
Cerium	58	Ce	140.12
Cesium	55	Cs	132.9055
Chlorine	17	Cl	35.453
Chromium	24	Cr	51.996
Cobalt	27	Co	58.9332
Copper	29	Cu	63.54
Curium	96	Cm	[247]
Dysprosium	66	Dy	162.5
Einsteinium	99	Es	[254]
Erbium	68	Er	167.2
Europium	63	Eu	151.96
Fermium	100	Fm	[257]
Fluorine	9	F	18.9984
Francium	87	Fr	[223]
Gadolinium	64	Gd	157.2
Gallium	31	Ga	69.72
Germanium	32	Ge	72.6
Gold	79	Au	196.9665
Hafnium	72	Hf	178.5
Helium	2	He	4.00260
Holmium	67	Ho	164.9303
Hydrogen	1	H	1.008

Indium	49	In	114.82
Iodine	53	I	126.9045
Iridium	77	Ir	192.2
Iron	26	Fe	55.84
Krypton	36	Kr	83.80
Lanthanum	57	La	138.905
Lawrencium	103	Lr	[256]
Lead	82	Pb	207.2
Lithium	3	Li	6.94
Lutetium	71	Lu	174.97
Magnesium	12	Mg	24.305
Manganese	25	Mn	54.9380
Mendelevium	101	Md	[258]
Mercury	80	Hg	200.6
Molybdenum	42	Mo	95.94
Neodymium	60	Nd	144.2
Neon	10	Ne	20.18
Neptunium	93	Np	[237]
Nickel	28	Ni	58.7
Niobium	41	Nb	92.9064
Nitrogen	7	N	14.0067
Nobelium	102	No	[255]
Osmium	76	Os	190.2
Oxygen	8	O	15.999
Palladium	46	Pd	106.4
Phosphorus	15	P	30.9738
Platinum	78	Pt	195.1
Plutonium	94	Pu	[244]

Polonium	84	Po	[209]
Potassium	19	K	39.10
Praseodymium	59	Pr	140.9077
Promethium	61	Pm	[145]
Protactinium	91	Pa	[231]
Radium	88	Ra	[226]
Radon	86	Rn	[222]
Rhenium	75	Re	186.2
Rhodium	45	Rh	102.9055
Rubidium	37	Rb	85.468
Ruthenium	44	Ru	101.0
Samarium	62	Sm	150.4
Scandium	21	Sc	44.9559
Selenium	34	Se	78.9
Silicon	14	Si	28.08
Silver	47	Ag	107.868
Sodium	11	Na	22.9898
Strontium	38	Sr	87.62
Sulfer	16	S	32.06
Tantalum	73	Ta	180.948
Technetium	43	Tc	[97]
Tellurium	52	Te	127.6
Terbium	65	Tb	158.9254
Thallium	81	Ti	204.3
Thorium	90	Th	[232]
Thulium	69	Tm	168.9342
Tin	50	Sn	118.7
Titanium	22	Ti	47.9

Tungsten	74	W	183.8
Uranium	92	U	[238]
Vanadium	23	V	50.941
Xenon	54	Xe	131.30
Ytterbium	70	Yb	173.0
Yttrium	39	Y	88.9059
Zinc	30	Zn	65.3
Zirconium	40	Zr	91.22

Note: Bracketed values indicate elements of which all known isotopes are radio active: the value given is the mass number of the isotope with the longest known half life.

Atomic Weight

Atomic weight values are determined by comparing the average weight of an element's atoms with the weight of the most abundant isotope of carbon, C^{12}, which is arbitrarily given the value 12. Since naturally occurring carbon is about 99% C^{12} and slightly more than one per cent C^{13}, the atomic weight of carbon is 12.011. A gram-atomic weight of an element is the amount whose weight in grams is numerically equal to the atomic weight. A gram-atomic weight of any element contains about 6.023×10^{23} atoms (Avogadro's number).

Compounds

A compound is a substance composed of the atoms of two or more elements chemically combines into molecules. Each molecule of a pure substance contains the same relative number of atoms. This also means that it contains the elements in a weight proportion that does not vary. The properties of a compound are the properties of its molecules, not those of its constituent elemental atoms. Thus, the water molecule is made up of 2 atoms of hydrogen

combines with 1 atom of oxygen and is written symbolically H_2O Hydrogen and oxygen are gases; water is a liquid.

Molecular Weight

Just as atoms can be assigned a relative atomic weight, so molecules have a molecular weight. This molecular weight is obtained by adding together the atomic weights of the atoms present in the molecule. In the water example above, its molecular weight will be about 18 (16 atoms). A gram-molecular weight of a substance is the amount whose weight in a grams is numerically equal to the molecular weight. A gram-molecular weight of any substance contains about 6.023×10^{23} molecules.

Mixtures

A mixture is a material composed of two or more pure substances. These retain their individual properties and characteristics after they have been mixed together. The proportions of a mixture, unlike that of a compound, can be varied. Furthermore, its constituents can be separated from each, other by nonchemical means. For example, a mixture of sand and salt will have some of the characteristic taste of the salt and the gritty feel of the sand. It can be separated by dissolving out the salt in water to leave the sand. The water then can be evaporated away from the salt solution to reclaim the salt.

Chemical Symbols, Formulas, and Equations

For the sake of convenience, the chemist has developed a kind of shorthand system by which he can record chemical reactions. This system consists of: (1) symbols, which represent the atoms of the elements; (2) formulas, which show how these atoms are combines into molecules; and (3) equations, which express chemical changes between molecules and atoms.

Symbols

Every element is represented by a definite symbol universally used in chemical literature and the same in all languages. The symbol stand for one

atom of an element. (The symbol are shown in the accompanying table. The Chemical Elements.)

Formulas

Every pure, substance, either an element or a compound, can be chemically identified by a formula. This indicates what elements are present and how many atoms of each are combined in the molecule of the substance. Thus in the example above, H_2O is the formula for the water molecule. Some formulas are very complicated. Vitamin B_{12} is $C_{63}H_{90}O_{14}Pco$. There is only one atom each of phosphorus and cobalt but larger number of the carbon, hydrogen, oxygen, and nitrogen atoms in the molecule.

Sometimes elements exist as molecules that are combinations of like atoms. Thus, hydrogen or oxygen gas is diatomic, H_2 or O_2. Some can be polyatomic, for instance, S_6 or P_4.

Equations

A chemical equation is a way of describing chemical changes. An equation indicates: (1) what substances enter into the reaction; (2) what substances result from the reaction; and (3) the number of molecules of each substance which enter into and result from the reaction. For example, when methane is mixed with oxygen, they combine explosively and water and carbon dioxide are formed. This reaction is expressed by the following equation :

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

The equation indicates that one molecule of methane (CH_4) combines with two molecules of oxygen (ad indicated by the coefficient 2 in front of the formula for oxygen, O_2) to form two molecules of water (H_2O) and one molecule of carbon dioxide (CO_2). Since the equation is balanced (has the same number of atoms of each element on both sides of the arrow), the reaction is

complete – all the methane and all the oxygen combine into water and carbon dioxide.

Because gram-molecular weights of all substances have the same number of molecules, the equation also indicates that one gram-molecular weight of methane (16 grams, approximately) will combine with two gram-molecular weights of oxygen (64 grams) to form two gram-molecular weights of water (36 grams) and one gram-molecular weight of carbon dioxide (44 grams).

1.3.2 Branches of Chemistry

The field of chemistry is very large one but broadly classified under four branches.

1.3.2.1 Physical Chemistry

1.3.2.2 Inorganic Chemistry

1.3.2.3 Organic Chemistry

1.3.2.4 Analytical Chemistry.

1.3.2.1 Physical Chemistry :

The branch that deals with the interpretation of chemical phenomena and properties in terms of the underlying physical processes, and with the development of techniques for their investigation. The term chemical physics is often employed to denote a branch of physical chemistry where emphasis is on the interpretation and analysis of physical properties of individual molecules and bulk system instead of their reactions.

Theoretical chemistry is another major branch where emphasis is on the calculation of the properties of molecules and systems and which used the techniques of quantum mechanics and statistical thermodynamics. Physical chemistry can be regarded as a subject dealing with three aspects of mater its equilibrium properties, structure and ability to change.

1.3.2.2 Inorganic Chemistry :

The branch of chemistry which deals with the chemical reactions and properties of all the elements in the periodic table and their compounds with the exception of the element carbon. The boundaries of inorganic chemistry with the other major areas of chemistry are not precisely defined and it is often a matter of taste as to whether a particular topic is to be included in the field of inorganic chemistry or is to be considered physical or even organic chemistry. Investigations into theoretical inorganic chemistry or the study of problems in inorganic chemistry by quantitative and sophisticated physical methods may be considered either inorganic or physical chemistry quite arbitrarily. To an increasing extent, the inorganic chemist is concerned with problems that once were considered the prerogative of physical chemists, organic chemists or even biochemists.

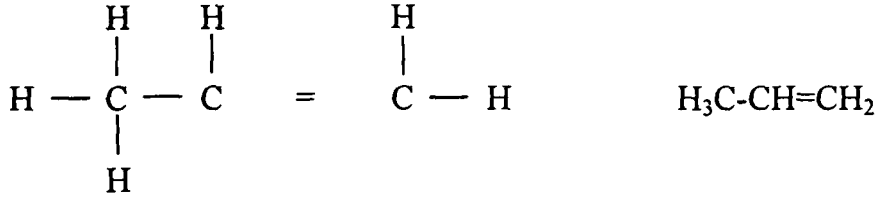
1.3.2.3. Organic Chemistry

The chemistry of the compounds of carbon. Organic chemistry owes its peculiar and important position to the fact that carbon, almost alone among the element is capable of uniting with itself indefinitely to form compounds. Carbon almost without exception displays a constant valence of 4 on these two principle the science of organic chemistry is built. The number of carbon compounds that are theoretically capable of existence is staggering and this very fact poses problems of major magnitude in connection with nomenclature, molecular structure and arrangement in space of the atoms comprising organic molecules.

Organic compounds in general differ from inorganic compounds by the nature of bonds by which the component atoms of a molecule are united. The valence bonds of most inorganic compounds are of the ionic or electrovalent type. In contrast covalent bonds or electron pair bond occur in organic

compounds. Due to the catenation property of over 1,00000 compounds are known today and many compounds are being processed daily. Over the years certain conventions for expressing molecular structures of organic compounds have been accepted. Standard practice represents a shared electron bond involving a single pair of electrons by a single line. Double bonds, involving two pairs of shared electrons are represented by a double line, and triple bonds, involving three pairs of shared electrons, are represented by a triple line.

Further simplification is often achieved by omission of bond lines when the meaning is obvious, as illustrated below with the hydrocarbon propane



$H_3C\text{-}CH{=}CH_2$

$H_3CCH{=}CH_2$

An organic compound containing only single bonds between carbon atoms is said to be saturated; a compound containing one or multiple bonds between carbon atom is said to be unsaturated

1.3.2.4. Analytical Chemistry :

The science of chemical characterization and measurement. Quantitative analysis is concerned with the description of chemical composition in terms of elements, compounds or structural units whereas quantitative analysis is concerned with the measurement of amount. The scope of analytical chemistry may involve the spatial distribution of elements or compounds within a sample, the distinction between different crystalline forms of a given element or compound, the distinction between different chemical forms (such as the oxidation states of an element), and the distinction between a component on the surface or in the interior of particles, and so forth. To

permit these more detailed questions to answered, as well as to improve the speed, accuracy, sensitivity and selectivity of traditional analysis, a large variety of physical measurement are used. These include methods based on spectroscopic, electrochemical, chromatographic, chemical and nuclear principles.

1.3.3 History of Chemistry

Many of the discoveries which are thought of as"Chemical" occurred long before man's recorded history. Some of them were accidental; all helped to develop civilization. After prehistoric man learned how to set fire to wood and other materials, he discovered how to heat some minerals (ores) to make metals. Bronze, which we now know is an alloy of copper, tin, and lead, was one of the first of these.

Tools and weapons made of bronze were sharper and harder than those made of stone. Later man learned that he could mix charcoal with ores when they were heated. Iron could be made this way and was even more useful thn bronze.

Early man also knew how to shape crude vessels from wet clay, letting it dry and harden. Somewhat later he discovered that these clay vessels would be more durable if he baked or fired them. He also developed a crude kind of glass.

The records left by early civilizations show no knowledge of chemistry as the science we know today. The ancients, however, were acquainted with many useful substances and the methods for their preparation. Certain plants and shellfish were found to yield dyes with which fabrics could be colored. Many herbs and roots were used as medicines. The bark of some kinds of trees produced a substance that tanned leather.

Some early people learned how to make paper, bricks, blown-glass vessels, and glazed pottery. These and other crafts were developed to a high degree, yet none of the ancient craftsmen understood the nature of the chemical

processes involved. Each craft and process was attributed to one god or another and regarded as a miraculous gift bestowed upon mankind.

Some of the philosophers of ancient Greece, however, attempted to explain the nature of matter. They believed that all substances were made up of four basic elements: air, earth, fire and water. These men advanced several theories as to why substances differ from lone another. Some of these theories were remarkably logical; many were almost correct, but none was ever tested by doing an experiment. Chemistry did not become a science until men began to investigate systemically the characteristics of the materials and natural forces making up their surroundings.

Alchemy

A forerunner of the science of chemistry flourished during the Middle Ages. This was alchemy, a mixture of black magic and scientific knowledge flavored with much superstition. Alchemists sought a mythical "philosopher's stone" with which they could transform the base metals, such as iron and lead, into gold. They also tried to compound an elixir of life that would make them live forever. They studied the classical Greek philosophers, especially Aristotle, who argued that all substances originated in some way from the four basic elements. The alchemist tried to find the "equintessence" (the fifth element), which could control the changing of one substance into another.

Although their efforts were largely misdirected, the alchemists contributed much useful information as a result of their experiments. Special kind of equipment, such as the test tube, the closed crucible, and the retort, still used in chemical laboratories today were devised by the alchemists. During the 16^{th} century, certain alchemists and physicians developed the theory that disease must be treated by experimental use of chemicals accompanied by observation. The chief proponent of this theory was Paracelsus, a Swiss physician and alchemist.

Rise of Modern Chemistry

At the end of the 1500's only 10 substances were definitely known to Europeans in pure form – carbon, sulfur, copper, iron, gold, silver, tin, lead, mercury, and antimony. All these had been known to the ancients. Arsenic may have been discovered by Albertus Magnus in the mid-1200's, but the arsenic and bismuth known to the alchemists were impure and were often confused with other substances. Zinc alloy had been used for thousands of years, but metallic zinc was known only in the Orient. Platinum was known to the Indian of Mexico and Central and South America, but probably not in pure form.

In the 17th century, men begun to question older ideas by doing experiments. This method led to discoveries from which the fundamental concepts of scientific chemistry were evolved. In 1661 Robert Boyle, an Englishman, published a book called The Sceptical Chemist. In it he defined elements as substances that could not be broken down into simpler substances nor formed by combining simpler substances.

At about the same time the theory prevailed that when a piece of wood or some other combustible material burned, an invisible substance called phlogiston escaped into the air. They phlogiston theory was put into final form by Georg Stahl, a German physician and chemist, about 1700. The English scientists Joseph Priestley and Henry Cavendish were among its chief proponents.

Antoine Lavoisier, a French chemist, discovered by careful weighing that metallic substances are heavier after they are burned than before. This led him to conclude that a burning substance combines with a gas (which he named "oxygen") in the air, rather than losing something called phlogiston. Lavoisier's experiments, performed in the late 18th century, conclusively disproved the phlogiston theory. Lavoisier's theory of combustion and his method of careful experimentation are so important that he is often called the "father of modern chemistry."

The 19th century saw further revolutions in chemical science. John Dalton, in 1807, formulated the atomic theory of matter. In 1828, Friedrich Wohler, a German chemist, prepared an organic compound, urea, in the laboratory. It was the first time that an organic compound had been synthesized. This synthesis proved that there was no essential difference between organic and inorganic substances, as had previously been believed. Dmitri Mendeleev, a Russian chemist, compiled the periodic table of elements in 1869, and predicted the discovery of several new elements. The discovery of radium in 1898 by Pierre and Marie Curie was another important development in chemistry.

20th-century Development

Many important advances in chemistry have occurred in the 20th century. In 1919, the British physicist Lord Rutherford bombarded nitrogen atoms with alpha particles (helium nuclei) to form oxygen and hydrogen atoms. This was the first man-made transmutation of an element, and marked the birth of a new field of study- nuclear chemistry. In 1938, Otto Hahn and Fritz Strassmann, German scientists, discovered the process of nuclear fission. Since World War II, radioactive isotopes produced in nuclear reactors have aided research in chemistry, biology, and medicine.

Chemical research has led to the development of thousands of synthetic materials that have made possible the establishment of new industries. Bakelite, the earliest synthetic resin, was produced in 1909. Since then, plastics such as polyethylene, Teflon, Lucite, and the silicones have found widespread application. Drugs such as the sulfa drugs, penicillin, antihistamines, and antibiotics have also been synthesized.

New instruments and techniques, have made it possible to determine the molecular structure of such complex substances as proteins, nucleic acids, and sterols. Photosythesis, carbohydrate metabolism, and other life processes are gradually being defined.

Space exploration, which began in the 1950's, placed new demands on chemical research. Heat-resistant materials, for space vehicles, and liquid and solid propellants, for rocket engines, are among the contributions of chemistry to the space age.

1.3.4 Scope of Chemistry

There is hardly a phase of daily life in which chemistry does not play a part. The foods we eat, the clothing we wear, the homes in which we live, and the countless material things we en joy have nearly all been influenced and improved by chemical research. Chemistry has also had effects upon our health, our attitudes, and our use of leisure time. In many fields of endeavor, including agriculture, the professions, and industry, there are countless examples of the contributions of chemistry.

Chemistry has played an important role in the conservation and preservation of food. During the Middle Ages, the only means of preserving food was by use of spices. Today foods can be kept from spoiling by such methods as refrigeration, adding chemical preservatives, irradiation, dehydration, or freezing. Chemical research has also contributed to the analysis of foods and a knowledge of their nutritive values. The discovery of vitamins resulted from chemical science. Because of chemistry, milk and certain other important foods have been made safe for consumption by the destruction of harmful bacteria.

An important contribution to clothing has been the development of synthetic materials, such as nylon, Orlon, and Dacron. Some natural fibers are chemically processed for strength and durability before they are spun or woven. Chemistry has also made it possible to bleach, dye, or dry-clean materials used in clothing.

Many materials used in the construction of homes are synthetically produced in the chemical laboratory. Wallpapers for home decoration are chemically treated to be made water-resistant. Airconditioning or air-cooling methods are also to a large extent the products of chemical research. Most important of all, however, are the sources of fuel and energy which make the 20^{th}-century home comfortable and convenient.

The development of the science of chemistry has made possible better diagnosis, prevention, and cure of diseases. Antiseptics, anesthetics, and numerous other drugs, such as penicillin and the sulfa drugs, have saved countless lives.

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Chapter - 2

The Study: Its Scope, Objective, Hypothesis, Research Methodology, Limitation & Significance

THE STUDY: ITS SCOPE, OBJECTIVE, HYPOTHESIS, RESEARCH METHODOLOGY, LIMITATION & SIGNIFICANCE

Citation analysis is one of the most important bibliometric techniques involving analysis of the references forming part of primary communication. Citation are formal explicit linkage between publication that have particular points in common.

Citoanalytical study of doctoral dissertation or these which are the products of research activity form an important source of information such studies may be useful for acquisition of materials, provision of better, services to patrons and knowing the location of materials. What part of literature is citer most, how long the literature remains useful to readers and languages of most cited publication, knowledge of all these provides guidance to collection development policies, individual item selection, and retention and binding decisions.

Such studies have been attempted in different subjects in natural sciences but paucity of such works exists in humanities and social sciences. However, some significant studies have been conducted in some areas of social science such as history, anthropology, political sciences, sociology and agricultural economics. The purpose of the present study is to investigate the use pattern of literature as revealed through the analysis of citation figuring in the doctoral dissertation of Chemistry accepted by A.M.U., Aligarh.

2.1 Scope

The present study is on 'Doctoral Dissertations submitted in the Department of Chemistry, Aligarh Muslim University, Aligarh from 1997-1998: A citation study'. The scope of the study is need to be defined in relation to the terms and concepts be used i.e.

- Doctoral
- Dissertation
- Submitted
- Department
- Chemistry
- A.M.U.
- Aligarh
- Citation
- Study

Defining Terms

2.1.1 Doctoral: These have different meaning

(i) The degree of doctor

(ii) A person who has been awarded a higher academic degree in any field of knowledge.

(iii) One who has received from a university the higher degree in a faculty.

2.1.2 Dissertation

Dissertation is a formal representation of research work under the supervision.

According to Webster's Third New International Dictionary

"A substantial paper that is submitted to the faculty of a university by a candidate for an advance degree that is typically based on independent research and that if acceptable usually gives evidence of the candidate mastering both of his own subject and scholarly method".

According to Peter Anger

"A statement of investigation or research presenting the authors finding and conclusion reached and submitted by the author in support of his candidature for a higher degree, professional qualification or other award."

2.1.3 Submitted

Submitted means to offer to another for consideration.

2.1.4 Department

Department means a part: a sphere of activity or duty: a selection of an administration, university, office: a division of a country.

2.1.5 Chemistry

Chemistry is a branch of science which embraces the properties, composition, structure of matter, the changes in structure and composition that matter undergoes, and the accompanying energy changes.

2.1.6 A.M.U.

It stands for Aligarh Muslim University. This is premier central university with several faculties and maintained institutions and draws student from all courses of the country as well as from foreign countries.

2.1.7 Aligarh

Aligarh is one of the important district of Uttar Pradesh lies on a vast, fertile and level alluvial.

2.1.8 Citation

It is a reference to a text or part of a text identifying the document in which it may be found.

2.1.9 Study

The devotion of time and attention to acquiring in formation or knowledge especially from books.

2.2 OBJECTIVES

The objectives of the study are:

- To identify the different forms of literature used by the researchers.
- To observe the authorship pattern in the field of Chemistry.
- To prepare a ranked list of journals and to find out the core journals.
- To identify the most productive country.
- To know the languages in which the most of the literature on the subject has been published.
- To identify in which subject area, most of the theses have been submitted.
- To identify the time period in which most of the journals have been published.

2.3 HYPOTHESES

1. Periodical is the most used form by researcher.
2. The frequency of multiple author is higher than single author.
3. The most cited journal is "Journal Chemical Society, Dalton Trans".
4. The most productive country is U.S.A.
5. Most of the literature is published in English language.
6. In Organic Chemistry, most of theses have been submitted.
7. The most of the journals were taken from during 1981-1990 and books from during 1971-1980.

2.4 METHODOLOGY

2.4.1 Selection of Source Document

16 Doctoral Dissertations submitted in the Department of Chemistry, A.M.U., in 1997 and 1998 were the source document for conducting this study.

2.4.2 Collection of Data

From 16 dissertations, 3741 references were noted down on 5" x 3" catalogue card from the last page of each chapter.

The following information has been noted on the card.

- AUTHORS NAME
- JOURNALS NAME
- YEAR

Finally all the collected data were recorded,. compiled, tabulated and analysed according to:

- Bibliographical form
- Ranked periodicals
- Ranked Authors (Periodical)
- Ranked Authors (Book)
- Ranked countries of cited periodical
- Ranked year of cited periodicals
- Ranked year of cited books.

2.4.3 ANALYSIS AND INTERPRETATION OF DATA

In this step all the cards were arranged and rearranged in order to complete the following studies.

2.4.3.1 Ranking of periodicals

This is to identify the core periodicals containing the research literature on Chemistry. For this purpose, a ranked list of periodical was prepared.

2.4.3.2 Country wise Distribution:

It is done to identify the place of origin of documents which is given in the Ulrich's International Periodical Directory. The entries were grouped on the basis of their places of origin. They were than counted and ranked in a table.

2.4.3.3 Year wise distribution of items:

It is useful to know the occurrence of source document. This type of study reveals the number of works during a time period. For this purpose a table has been prepared for year wise distribution.

2.4.3.4 Language wise Distribution of articles

For the distribution of item according to language a table has been made in which entries were grouped according to their language of origin.

2.4.3.5 Form wise Distribution

The literature published in different forms i.e. journals, books, bulletin, theses report etc. The information was collected from 16 theses and total reference were 3741.

2.4.3.6 Ranking of Authors

It is done to know the most productive contributors in the subject. For the purpose of ranking of author a table has been prepared and ranked in decreasing order.

2.5 LIMITATION

1. The study is only limited to the doctoral dissertation submitted in the Department of Chemistry, A.M.U. from the 1997 and 1998.

2.6 SIGNIFICANCE

(1) Such studies can serve as guidelines for the librarians to decide which publication should get a higher priority for acquisition.

(2) Such studies can serve as guidelines to the documents lists and information scientists in deciding which publication need to be indexed in current awareness service and covered in SDI service.

(3) This study can help the researchers to decide as to which form of documents will be helpful in their research work.

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Chapter - 3

Citation Analysis: Its Definition, Historical Background, Purpose and Indexex

3.1 CITATION

Harrods defines citation as "It is a reference to a text or part of a text identifying the document in which it may be found". A list of publication to which an author has made specific reference; usually placed at the end of an article or chapter, or at the end of a book, sometimes in chapter order. The entries are usually arranged in number order, corresponding numbers appearing in the text is called citation.

Ethics of communication claims that previous concepts, methods, apparatus, etc., used in the current document, should be duly recorded with the help of citations. Citations are used not only to pay homage to pioneers and give credit for related work but also to criticise, correct and dispute previous contributions. Whatever may be the reasons of their occurrences, citations seek to identify much of the earlier works that are pertinent to the subject of the citing document and thus provide further, reading lists for the users.

3.2 CITATION ANALYSIS

Citation analysis denoted the mathematical analysis of citation or references appended at the end of each scientific communication as an essential and integrated part of it. The bibliography or a reference is customarily presented by the author or the scholar of a scientific paper in a given field as an authentic source of information having research value or to substantiate the point of view of ideas expressed in the cited papers, citation analysis thus has become a major thrust area of bibliometrical research today. It is used as a measure of impact of individual articles, periodicals, author etc and has become an accepted practice in almost all scientific communications and a well established part of information research. It is one of the areas of bibliometrics which can be used for identifying. The core periodicals and the characteristic

features of a discipline such as authorship pattern, scatter of literature in different bibliographical forms and subject etc.

Citation analysis as a tool, was initially used to identify the core periodicals in a subject through counting the references of a theses from a group of primary periodicals, which was subsequently extended to the citations found in theses, books and reviewing periodicals.

3.3 Citation Analysis: Its Definitions

Citation analysis is a techniques of bibliometric study of literature based upon some degree of relationship between citing and cited articles or documents.

According to Martyn[1], "citation analysis has been defined as an analysis of the citations or references which form part of the scholarly apparatus of primary communication."

As Garfield[2] point out, "citation frequency is a measure of research activity, or of communication about research activity""

Broadus[3] defines the "true citations analysis as one which deals with works cited as having actually been used in preparation of, or having otherwise contributed to, the source paper."

Citations is used to trace the diffusion of an idea and pointed out that some papers became socio-metric stars while other are isolated. The frequency of the cited documents appearing in a number of citing articles is, in some measure, an indication of its influence or impact on the subject. The technique of citation is largely statistical and is used for arranging those cited material in some kind of rank to study their relative importance.

A citation, that is to say, is not a unit but an event, and only immediately quantifiable in terms of its frequency of occurrence. For some purposes, the simple frequency may be an adequate measure. Bearing in mind that citation is a practice only engaged in by authors, and that authors of published papers area

comparatively small proportion of the total population of scientists and technologists, then raw citation counting can be used to divide the universe of potentially citable documents into groups, those which have demonstrably been of some undetermined relevance to the work of authors, and those which have not demonstrably been of use. Common sense suggests that the most heavily cited material are those which have a higher probability of being cited in future, than those which have not been cited, and consequently journal acquisition policies can be based on raw citations counts as a rule-of-thumb measure, although such counts require considerable modification if they are to be anything other than rule-of-thumb.

3.4 Citation Analysis: Its Concept and Historical background

The word "Bibliometric" or citation analysis was first coined by Allen Pritchard[4] in 1969 to mean an application of mathematical and statistical method to books and other media process of written communication and of the nature and course of a discipline. The earliest attempt at using statistical methods for studying subject scattering was made in 1896 who applied this method to ascertain subject scattering of articles covered under some national and international bibliographies. Cole and Eales[5] (1917), Gross and Gross[6] in 1927 used citation count to rank the periodicals in Chemistry which was regarded as the first user study of any significance based on a more systematic citation count that later became that basis and a ,methodological direction to the Bradford's law of scattering. S.R. Ranganathan coined the term librametry for quantitative studies and analysis of library activities.

Citation analysis as an effective tool in periodical evaluation. The primary function of citation is to provide "a connection between two documents, one which cites and the other which is cited". There are umpteen number of reasons for giving citations. Weinastok, Lipetz, Moravacik Murugesan, Hodges, Openheim and Renn, Finney, Forest and Thorne have all

attempted to expl;ore the possible reasons to for giving citations. They include the positive and negative reasons for inclusion. However, it has to be concede that if the reason is positive, there is bound to have some connection between the citing and cited paper.

3.5 Citation Analysis: Its purpose

Citation analysis is very often fruitfully applied to derive the following benefits

(a) To lead the reader to further studies in the field

This is the primary purpose of citations. Readers can verify the correctness of information and thereby convince themselves.

(b) For the preparation of bibliographies

The first use of citation indexing was made in Sheperd's[7] citations published in 1873. It is a fact that compilation of bibliographies in new field is really difficult. In such circumstances, analysis of citation articles may be the only way to gather information. The very fact that the citations have been verified, evaluated and recommended by authors who are experts in their own fields make them all the more acceptable for inclusions in a bibliography.

(c) To study the use pattern of different types of documents

Citation given may be of books, journal articles, reports, standards, theses/dissertations etc. The relative use of each of these types can be ascertained based on the frequency of citations.

(d) To find out the relative use of different languages

Since English has emerged as a world language, especially science and technology there is a predominance of English language publication in all branches.

(e) To study the use of literature from different countries

From the citations, the country of their origin can be identified in all types of materials like journal, articles, books, reports etc. In many subject areas, U.S. Publications are found to be used more heavily.

(f) To prepare ranked list of periodicals

The number of items contributed by different periodicals during a specific period of time is calculated from the secondary source and the ranked list is prepared based on the productivity of journals. Such ranked lists are very often used as guidelines in the acquisition of periodicals and other materials in the library.

Citation analysis is a suitable technique to evaluate the contribution of scientists and predict the major contributions in any field of study. The analysis helps to identify classics and study mechanism of development of a subject. The combination of quantitative and qualitative dimensions can be seen in citation analysis, which qualitatively analysis the link between the cited and citing documents and quantitatively studies the variables. By citation analysis one can evaluate and interpret citations received by articles, authors, institutions and other aggregates of scientific activities.

3.6 CITATION INDEXES

A citation index is an ordered list of cited articles each of which is accompanied by a list of citing articles. The cited article is identified as a reference and the citing article as a source. The association of ideas existing between the cited and the citing articles is utilised in the preparation of this index. It may perhaps he said that cited articles are, ancestors and the citing articles are descendants and this descending relation of subjects is reflected through the index.

The method has provided a new approach to the problem of file organisation, which overcomes many shortcomings of traditional indexing

systems. The primary advantage of citation indexing is that it identifies relationship between document that are often overlooked in a subject index.

An important secondary advantage is that the compilation of citation indexes is especially well suited in the use of man-machine indexing method that do not require indexers who are subject specialists. This helps to make citation more current than most subject indexes.

Citation indexing is based on the simple concept than an author's references to previously recorded information identify much of the earlier work that is pertinent to the subject of his present document.

These references are commonly called citations and a citation index is a structured list of all the citations in a given collection of documents. Such a list are usually arranged so that the cited document is followed by the citing document.

3.6.1 Science Citation Index

The first science citation index was first published in 1963. The first SCI covered the literature of the calendar year of 1961.

The subject coverage of the science citation index is science and technology in general. It started in 1964, with a coverage of 700 periodicals and all U.S. patents. Subsequently, the patents were dropped and the number of periodicals covered increase each year. The science citation index started initially with two parts-citation Index and source index. Subsequently, from 1966, another part was introduced called Permuterm subject Index.

3.6.2 Genetics Citation Index

In 1961, the National Institute of Health initiated a cooperative program with Gradfield's Institute for scientific information (ISI) to prepare a citation index for the field of Genetics.

Garfield soon recognized, however, that defining the genetics literature to be covered by a citation index would be quite difficult. Fine judgement would be required as to what was or was not genetics literature. As Garfield's suggestion, it was decided to undertake a comprehensive, interdisciplinary approach to preparing a citation index and than extract a Genetics citation index from that base of information.

3.6.3 Social Sciences Citation Index

The ISI social science citation index provide access to current and retrospective bibliographic information, another abstract, and cited references found in over 1700 of the world's leading scholarly social science journals covering more than 50 disciplines.

3.6.4 Arts and Humanities Citation Index

The ISI Arts and Humanities citation index provide access to current and retrospective bibliographic information and cited references found in over 1,120 of the world's leading arts and Humanities journals.

3.6.5 Derwent Innovation Index

Derwent world patent index with the Derwent patent citation index updated weekly, it covers over ten million basic inventions-18 million patents in all form over 40 patent issuing authorities.

3.6.6 Other Citation Index

Other than the examples mentioned above, efforts have been made to produce citation indexes or to utilise the principle of citation indexing for dissemination of information. But most of them were adhoc attempts published on experimental basis.

Citation indexes provide coverage of material published in just one journal one of the earliest examples of this is the cumulative index to volume

35 through 50 of the journal of the American Statistical Association. Another example of a citation index with single journal coverage is the one that appears in a cumulative index to volume of through 31 of the Annals of Mathematical Statistics.

An example of citation index that covers more than one journals but is limited to a single field is the citation index for statistics and probability which is being currently produced by Dr. J.W.Tukeey at Princeton University. This project was initiated in 1961 and is being conducted in cooperation with the National Science Foundation. In 1968, the Shepard Organization itself introduced Shepard's Law Review Citations. This new publication indexes 117 law reviews and periodicals and shows where any legal article written since 1977 has been in the covered journals from 1957 onwards.

As a final example special indexes can be prepared on demand through system that directly connect the users with the database, as is done with Technical Information Project (TIP) at the Massachusetts Institute of Technology. TIP uses a time sharing computer connected to remote consoles by telephone cables. The database consists of the full bibliographies of articles from 25 recent physics journals. Thus, a user can obtain a citation index to all the articles, or articles from only one of the covered journals, or to the articles in a single volume of a covered journals.

3.7 CITATION ANALYSIS : ITS SIGNIFICANCE

Journals are said to play a fundamental role in the development of all disciplines and professions. The disseminate knowledge written contemporary scholar and aid in continuing development of a profession's knowledge base.

The most significant factors i.e. information explosion its varied form and the rising cost due to the recent drastic devaluation of rupee and the inflation abroad have posed a great problem to the librarian in acquisition. According to UNESCO there are over 6,00,000 document being published

every year in more than 80 written languages. Out of these documents, 3,00,000 alone are traditional books, 1,50,000 are periodicals and rest 1,50,000 other type of documents like reports, patents, governments publications, paper etc. The world growth of scientific literature is estimated at 6-7% a year. The role of growth is so rapid that the scientific literature is getting doubled every year.

Cost is another factor for concern. It is said that the price of books has gone up by 40% since January 1991, where as the cost of the periodicals keeps on increasing by 15-20% each year. According to a survey of expenditure incurred by Roorkee University, the cost of journals doubles every fourth year. This has outstripped the purchasing capacity of libraries all over the world. It is said that even a very rich library like the Library of Congress of the U.S.A., whose budget is in several crores of rupees, will not be able to procure each and every document that is being published from different parts of the world and in the different forms and languages. Therefore, to avoid difficulties created by the inflation on the one hand and the shrinking fund position on the other, a purposeful study of evaluating the types of literature and of selecting periodicals according to their use value is of immediate interest and need. Hence through the citation analysis an attempt has been made to social science.

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Chapter - 4

Review of the Related Literature

REVIEW OF THE RELATED LITERATURE

Review of the related literature is very essential for a new research topic. Study of related literature implies locating, reading and evaluating reports of research as well as report of casual observation and opinion that are related to the individual's planned research project. The search for literature should be conducted in a systematic way to achieve optimum results. Otherwise the search may lead to wastage of labour and time and poor retrieval of relevant information. In brief this chapter presents an overall review of study conducted abroad as well as in India in a chronological order. The researcher has only reviewed those studies which were similar to the present study or indirectly related to the present study.

Maheshwarappa, BS and Nagappa, B[1] (1987) conducted a study under the title ***"Research Collaboration in the field of Phytopathology: A Bibliometric Study"*** The main objectives of the study were to identify the nature, and pattern of multiple authorship and to determine the degree of collaboration in research in the field of Phytopathology. The source material of the study was 'Review of Plant Pathology. The findings reveals that the average number of authors per paper has increased from 1.29 in 1931 to 2.13 in 1981. There has been an increase in the frequency of multiauthors papers from 22.1% to 70.38%.

Kochar, Ved B and Verma, R K[2] (1987) made a study under the title ***"Indian Biotechnology Literature: A Bibliometric Study"***. The main objectives of the study were (I) to foster better coordination among Indian scientists, (ii) attempted to survey the literature output from various Indian Institution among various journals and branches of the subject. The data was collected from Bibliography of the Indian literature on biotechnology (1983-84) of Derwenl's Biotechnology Abstract. The finding reveals that out of total

783 entries, 617 (78-79%) appeared in 87 Indian and foreign journals and 166 (21.2%) in conference/seminar literature. The journal phytochemistry covers maximum contribution i.e. 122 (19.77%).

Aravind, P and Reddy, V Pulla[3] (1989) conducted a study on ***"Physical Authropological Literature: a citation Analysis"***. The objectives of the study were to know the citation in different bibliographic forms, the authorship pattern, to identify the core journals: The data was collected from 12 review articles published in Annual Review of Anthropology during the years 1980-1982. There were 1,848 citation cited by these review articles. The journal literature contributed the highest number of citation 54.76%. In authorship pattern 66.56% of citation were contributed by single author. The study shows that most of the literature were published in 'Physical Anthropology' and most of the contributors are single authors.

Sangam, S.L[4] (1989) made a study under the title ***"Information use pattern of research in the field of Psychology: A citation study"***. The main objectives of the study were (İ) use of different sources of information and their dispersion by subject, country, and language (ii) Important journals used and their availability at Karnataka University Library, Dharwad and to apply the Bradford's Law of scattering to the journal use pattern of research in Psychology. Twelve Doctoral theses accepted during 1964-1982 by the Karnatak University in the field of Psychology, were taken for the study. 1,984 references were collected from the source data. The finding reveals that the books were the major source of information i.e. 82.81% .

Arjun Lal[5] (1993) made a study under the title ***"Most important journals from the point of view of Indian Soil Scientists: A Bibliometric study"***. The main objectives of the study were to find out the major form of

literature, to make a comparison of first ranked journals, to identify the most productive country. Four volumes of journal was taken for study. There were 6273 references. The finding reveals that the journal literature contributed the highest number of citation 4354 (69.41). 'J. Indian. Soc. Soil Sci.' occupied the first rank (18.31%) and the most productive country was India.

Rana Madan S and Aggarwal Sunita[6] (1994) made a study under the title ***"Authorship Trends in Indian Wildlife fisheries literature: A bibliometric study"***. The main objective of the study was to identify the authorship pattern in Indian Wildlife and fisheries literature. The data was collected from "Wildlife Review and Fish Review" from 1980-89. The finding reveals that single authored papers has decreased from 64% in 1980 to 52% in 1989. During the same period there was an increase in the average number of authors per paper from 1.57% in 1980 to 1.70% in 1989.

Verma, Maya[7] (1994) made a study under the title ***"Citation analysis of some Selected Indian journals in Economics"***. The main objective of the study was to identify the literature published used by Indian scholars. The data was collected from three Indian journals in Economics from 1986-90. There were 2599 references. Ranking list shows that Indian Economists use more foreign literature and most of the journals subscribed by university library does not find place in ranked list.

Arora, Jagdish and Kaur Sharan Pal[8] (1998) made a study under the title ***"Bibliometric Analysis of Core journals on Immunology: A study based on the Annual review of Immunology"***. The main objectives of the study were to determine country, subject, physical format, chronological and language distribution of core journals in immunology. The data was collected from the Annual review of immunology from 1983-1986. The total citation

were 10830. Among total citation 10024(92.56%) citation published in primary literature and 806 published in other forms of publication. 66 core journals in the fields of immunology were identified and listed in decreasing frequency of citation. The ranked list indicates that the journal of immunology and the journal of experimental Medicine were two highly cited journals that occupied first two position.

Kalyane, V.L. and Sen, B.K.[9] (1995) conducted a study on ***"Bibliometric study of the journal of oilseeds research"***. The main objectives of the study were to find out the authorship pattern, prominent contributors, location of oilseed research. The data was collected from 498 research articles comprising 241 full length research papers and 257 short communication published during 1984 to 1992 in journal of oilseeds research. Two authored papers were found to be maximum which accounts for 39% and single authored paper accounts for only 12%, on an average.

Mubeen, M.A.[10] (1996) conducted a study under the title ***"Citation Analysis of Doctoral Dissertation in Chemistry"***. The main objectives of the study were to identify core journals, country of origin and authorship pattern. The finding reveals that there was 60 core journals, out of total 418 journals. Most of the work were contributed by single author. There were only few countries which can be depended on for original research information.

S.P. Ushadevi[11] (1997) made a study under the title ***"Indian Journal of Agricultural Economics: A Bibliometric study"***. The main objectives of the study were to identify the number and form of the cited documents, most cited journals, Geographical dispersion of cited journals and subject dispersion of cited journals. The most cited journal was 'Indian Journal of Agriculture

Economics' 279 (18.64%) followed by 'Economic' and 'Political Weekly.' The most productive country was India.

Biradar, B.S. and Ms.Vijaylaxmi, T[12] (1997) conducted a study under the title ***"Pattern of information use by Indian Neurological Scientist: A Bibliometric study"***. The main objectives of the study were (i) To identify the forms of literature used by the scientists. (ii) To identify the average number references per dissertation. (iii) To prepare a rank list of most frequently used journals. There were 3635 references in the form of literature cited at the end of 39 M.D.(Neurology) dissertation (1979-1996). The finding reveals that first twenty five journals received around 70% references. Among the cited journals, 'Neurology' occupied the first rank.

Sudhier, K.G.[13] (1997) made a study under the title ***"Contribution of Kerela to Indian Science: A Bibliometric Analysis"***. The main aim of the study was to investigate into the characteristic feature of the scientific research in Kerela by analysing the contribution of scientists. 'Indian Science Abstract' was taken to locate the contributions of the researchers in Kerela. The period chosen for the study was from 1979 to 1994. Various aspects e.g. author, subject, institution were taken for analysis. The finding reveals that the researchers were more in the field of Agriculture and Kerela was the first state in the country to contribute a separate department for science and technology.

Mishra, R.N. and Panda, K.C.[14] (1997) conducted a study on ***"Citation analysis of Doctoral Dissertation in LIS accepted by the Universities of Orissa and Manipur till 1993"***. The main objectives of the study was to identify the mostly used form of document by LIS scholar, to identify the most productive country, to find out the core journals etc. The collected data was tabulated according to their Bibliographical forms, ranked

periodicals, ranked author and ranked countries. The finding reveals that periodical literature ranks as the first most cited form of document the most productive country was India.

Korah, Accamma C and Jose, Mercy[15] (1997) made a study under the title ***"Literature on rubber research: A bibliometric study"***. The main objectives of the study were to analyse the literature on rubber literature covered the period 1984-1988. Mainly the primary journals were referred, otherwise the secondary journals was recorded to subject, author(s) year etc, with regard to each published paper. The analysis of authorship pattern reveals that single author accounts for 40.93% and higher percentage of the publication were with multiple authors.

Sangam, S.L. and Nargund[16], IN (1997) conducted a study under the title ***"Trend in Research publications by Indian Physist: A Bibliometric study"***. The main objectives of the study were to identify the forms of documents in which Indian Physicist have communicated their research work, identify the scatter of Indian Physist research papers in foreign journals and which were the highly productive journals in the field of physics.

The finding reveals that out of the total 3167 articles published by the Indian Physist during the year 1993. 96% of them were published in periodicals on the other hand non serials were accounted for only 3.09% of total articles and more than 6% of research papers from Indian physist get published in foreign journals.

V. Jaleja[17] (1997) made a study under the title ***"Bibliometric Analysis of Science journals published from India"***. The main objectives of the study were to identify a list of core journals in science subject and to study the scattering pattern of literature of science subjects in different journals and to

determine the year wise productivity in the 13 science subject. There were thirteen main subject selected for study. Survey and document analysis were the main techniques used for collecting data. Document analysis, preparation of frequency distribution, calculation of percentages, graphical representation and statistical analysis are also used. The finding reveals that scattering of science periodical follows Bradford's Law of scattering in all the 13 subjects. Core journals, those which are in the nucleus of each of the above subjects were found out. This study indicates the exponential increase of productivity of all these subject except chemical technology and Manufacture because it shows slight decrease in references in 1988.

Varma, A.K.[18] (1997) made a study under the title ***"A Bibliometric study of Ph.D. Theses in Botany"*** The main objectives of the study were to identify the core journals, to identify users and authorship of documents on various subjects. The data was collected from 30 theses of Botany. There were 2865 references. The finding reveals that the journal 'Phytopathology' occupied the first rank (7.46%) and most of the paper were contributed by double author i.e. 40.75%.

Rajanma, P.K.[19] (1997) made a study under the title ***"Tuber crops research in India: A Bibliometric analysis"***. The main objectives of the study were to ascertain the strength and weakness of the research activities, to identify the core journals, the authorship in the field of tuber crops research. The data was collected from "Journal of Root Crops". The finding reveals that research in tuber crops was mainly centered in two major crops viz. Cassava and Sweet potato which occupied 39.56% and 24.67 respectively. The most papers were contributed by Multiple author.

Thajuddin, S[20] **(1998)** conducted a study under the title ***" Journal of Plantation Crops: A Bibliometric Appraisal"***. The objectives of the study

were to identify the nature of communication, geographical distribution, authorship pattern and citation. The data was collected from 24 volumes of journal of plantation crops. The finding reveals that there was 558 articles, out of 558, 320 (57.35%) were full length research articles, 46 (8.24%) were reviewed articles. 502 articles was authored by Indians. In authorship pattern the higher citation were contributed by two authors i.e. 38.17%.

Wai Sin, Tiew[21] **(1998)** made a study under the title ***"Journal of Natural Rubber Research 1987-1996: A ten year bibliometric study".*** The objectives of the study were to examine the nature of authorship pattern in this journal, to determine the frequency and number of references cited by the researcher in the field of natural rubber. The content page of each issue was collected to study the extent of collaborative research in each of the article published between 1987-1996. The finding reveals that two authored articles comprised the highest percentage (35.3%) of the total 258 articles. The range of references cited in the research articles of journal of Natural Rubber research was 16.49%.

Halkar, Griraj; Sengupta, S.K. and **Chand Salek**[22] **(1998)** conducted a study under the title **"Journal of Family Welfare :A Bibliometric study"**. The main objective of the study were to determine (I) year wise distribution of papers (ii) Distribution of contribution among type of organization (iii) Authorship pattern (iv) subject wise break-up (v) The country wise distribution of papers out of 43 volumes of the journal of Family Welfare published so far, eight volumes (36-43) 1990-97 were under study. For the subject wise analysis, Popin Thesaurus has been used for classification of the articles. The total number of contributions in the eight volume issue were 276. It consists of main articles, technical and analytical notes. The conclusion of this study reveals that distribution of articles from 1990 to 1997 in the journal of Family Welfare

is consistent as the difference between maximum and minimum number of articles is six. Authorship pattern shows that most of the papers were contributed by single author (52.18%). India contributed the maximum number of articles i.e. 80.07%.

Joginder Singh Burman[23] (2000) made a study under the title **"Doctoral Research in IMTECH: document use pattern:"** The main objective of the study were to identify the bibliographic form, authorship pattern etc. The data was collected from 20 doctoral dissertation available at the Institute of Microbial Technology (IMTECH) library, Chandigarh. There were 4752 references. The finding reveals that 85% citation were from journals. Journal literature was mostly contributed by multiple authors i.e. 87%.

Prakash Chand and **Dharmendra Singh Senger**[24] (2000) conducted a study under the title " **A Bibliometric study of solar energy research in India".** The objectives of the study were to identify trends in the field of solar energy research in India, to know the ranking of institution in the field of solar energy, to analyse the R & D output quantitative and qualitative. The data was collected from ISA, INPAT, INSPEC, SCI Database of annual report of Indian R & D organisation covering 1992 – 1997 period. The finding reveals that IITs contributes major share i.e. 191 papers 38%. Second place goes to universities which were contributing 150 papers and third R & D institutions contributing 91 papers (18%).

Sahu, T. R.[25] (2000) conducted a study under the title ***"National Mapping of Science India: Earth Sciences".*** The main objectives of the study were to know the most prolific contribution of different institution, to find the core journal of India also top ten source publishing Indian contribution. The finding reveals that Geographical survey of India was found to be most prolific

contributor in all three years, and the second contributor was 'Wadia Institute of Himalian Geology'. A large number of Indian contributer appeared in Indian publication.

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Chapter - 5

Data Analysis, Interpretation and Presentation

DATA ANALYSIS, INTERPRETATION AND PRESENTATION

Data was collected from 16 doctoral dissertations submitted in the Department of Chemistry during 1997 and 1998. The collected data was used for further analysis.

5.1 Distribution of Dissertations submitted in the Chemistry Department, A.M.U.

Table 5.1 shows that in 'organic chemistry' most of the dissertations were submitted in the Department of Chemistry during the year 1997 and 1998. 6 out of 16 i.e.(37.5%) dissertations were submitted in 'organic chemistry' followed by 'physical chemistry' i.e. 5 (31.25%)

TABLE 5.1

DISTRIBUTION OF SUBJECT

S.No.	Rank	Subject Area	Year		Total	Percentage	Cumulative percentage
			1997	1998			
1.	1	Organic Chemistry	3	3	6	37.5	68.75
2.	2	Physical Chemistry	2	3	5	31.25	37.5
3.	3	Inorganic Chemistry	1	2	3	18.75	87.50
4.	4	Analytical Chemistry	2	0	2	12.50	100.00
Total :			**8**	**8**	**16**		

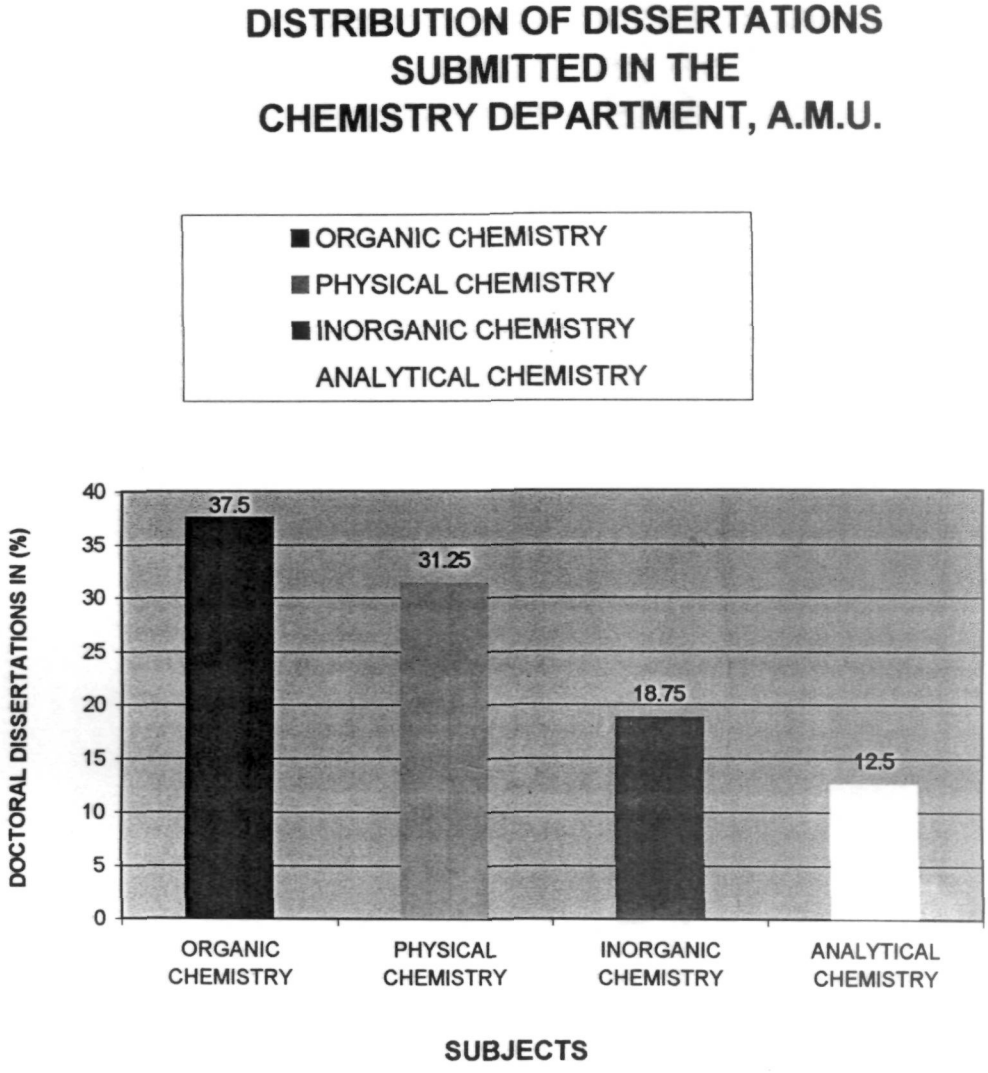

DISTRIBUTION OF DISSERTATIONS SUBMITTED IN THE CHEMISTRY DEPARTMENT, A.M.U.
ORGANIC CHEMISTRY
PHYSICAL CHEMISTRY
INORGANIC CHEMISTRY
ANALYTICAL CHEMISTRY
DOCTORAL DISSERTATIONS IN (%)
40
35
30
25
20
15
10
5
0
37.5
31.25
18.75
12.5
ORGANIC CHEMISTRY
PHYSICAL CHEMISTRY
INORGANIC CHEMISTRY
ANALYTICAL CHEMISTRY
SUBJECTS

Figure 5.1

5.2. RANKING OF PERIODICALS

As the periodicals are important source of current information, they play a vital role in scientific communication. The periodicals that contribute most of the literature in a given field are called core journals. Identification of core journals in the subject under study will be useful from the point of view of researchers.

The main aim of the present study is to identify the most important journals containing the most of the literature of research value in the field of Chemistry.

In the collected data, 3028 reference appented to the Ph.D. theses were ranked upto 43rd position. However, Table 5.1 lists only 130 periodicals, in which the frequency of occurrence of items is up to 3. The periodical with less than 3 items have not been considered. Table –1 shows that the first rank was occupied by the journal titled 'Journal Chemical Society' which accounts for 7.23% of total references. Next four positions are occupied by journals like 'Journal American Chemical Society' (5.58%) 'Inorganic Chemistry' (3.66%) 'Analytical Chemistry' (3.50%) respectively.

Table 5.2

RANKING OF PERIODICALS

S.No.	Rank	Name of Journal	Frequency of occurence	Percentage of frequency	Cummulative percentage
1.	1	Journal Chemical Society, Dalton Trans	219	7.23	7.23
2.	2	Journal American Chem. Soc.	169	5.58	12.81
3.	3	Inorganic Chemistry	111	3.66	16.47
4.	4	Analytical Chemistry	106	3.50	19.97
5.	5	Journal Chromatogr	103	3.40	23.37
6.	6	Journal Physical Chem.	93	3.07	26.44
7.	7	Journal Memb. Sci.	63	2.08	28.52
8.	8	Journal Ind. Chem.	60	1.98	30.5
9.	9	Inorganic Nucl.Chem.Lett.	57	1.88	32.38
10.	9	Journal Pharm.Biomed. Anal.	57	1.88	34.26
11.	10	Talanta	54	1.78	36.04
12.	11	Journal Organic Chem.	53	1.75	37.79
13.	12	Journal Ind.Chem.Soc.	49	1.61	39.4
14	13	Polyhedron	45	1.48	40.88
15.	14	Tetrahedron	43	1.42	42.33

16.	15	J.Chem. Soc. Chem. Commn.	42	1.38	43.68
17.	16	Analyst	39	1.28	44.96
18.	17	Anal.Lett.	35	1.15	46.11
19	18	J. Colloid Interface	34	1.12	47.23
20.	18	Biochem. Biophys. Acta	34	1.12	48.35
21.	18	Journal Biological Chem.	34	1.12	49.47
22.	19	Solid State Ionics	32	1.05	50.52
23.	20	J. Neurochem.	31	1.02	51.54
24.	20	J. Pharm.Sci.	31	1.02	52.56
25.	21	Biochemistry	30	0.99	53.55
26.	21	Anal. Chim. Acta	30	0.99	54.54
27.	22	Phytochemistry	29	0.95	55.49
28.	23	Aust. J. Chem.	26	0.85	56.34
29.	24	Nature	25	0.82	57.16
30.	25	Tetrahedron Letters	24	0.79	57.95
31.	26	Synth. React.Inorg. met.org.chem.	20	0.66	58.61
32.	26	Journal Liq. Chromatogr	20	0.66	59.27
33.	27	Journal Solid State Chem.	19	0.62	59.89
34.	27	Indian Drugs	19	0.62	60.51
35.	27	Chromatographia	19	0.62	61.13
36.	28	Transition Metal Chem.	18	0.59	61.72

37.	28	Sep. Sci. Technol	18	0.59	62.31
38.	29	Biophysics Journal	17	0.56	62.87
39.	30	Oxid Comm.	16	0.52	63.39
40.	30	Helv. Chim. Acta	16	0.52	63.91
41.	31	Journal Chem. Phy.	15	0.49	64.4
42.	31	Zh. Prikl Khim.	15	0.49	64.89
43.	32	Can. Journal Chem.	14	0.46	65.35
44.	32	Journal Electroanal Chem.	14	0.46	65.81
45.	33	Inter. Journal Chem. Kinetics	13	0.42	66.23
46.	33	Journal Assoc. Physic Ind.	13	0.42	66.65
47.	34	Journal Assoc. of Anal Chem.	12	0.39	67.04
48.	34	Zh. Anal. Khim.	12	0.39	67.43
49.	34	Journal Planer Chromatogr.	12	0.39	67.82
50.	34	Journal Memb.Biol.	12	0.39	68.21
51.	34	Langmuir	12	0.39	68.60
52.	35	Anged Chem. Ind. Edn.Engl	11	0.36	68.96
53.	35	Science	11	0.36	69.32
54.	36	Indian Journal of Chem.	10	0.33	69.65
55.	36	Chem. Commun.	10	0.33	69.98
56.	36	Chemistry and Industry	10	0.33	70.31
57.	36	Anal Biochem	10	0.33	70.64

58.	36	Colloids & Surface	10	0.33	70.97
59.	37	Trans Faraday Soc.	9	0.29	71.26
60.	37	Anal. Chim Acta	9	0.29	71.55
61.	37	Microchem. Acta	9	0.29	71.84
62.	37	Faraday Trans.	9	0.29	72.13
63.	37	Journal Organomet Chem.	9	0.29	72.42
64.	38	Fresenius Journal Anal.	8	0.26	72.68
65.	38	Acc. Chem. Res.	8	0.26	72.94
66.	38	Journal Radioanal Chem.	8	0.26	73.20
67.	38	Z. Phys. Chem.	8	0.26	73.46
68.	38	Journal Nat. Prod.	8	0.26	73.72
69.	38	Inorg. Chem. Acta	8	0.26	73.98
70.	39	Biochem. Journal	7	0.23	74.21
71.	39	Journal Agriculture Food Chem.	7	0.23	74.44
72.	39	Pure Applied Chem.	7	0.23	74.67
73.	39	Acta Chim. Hung	7	0.23	74.90
74.	39	Ind. Journal Environ. Health	7	0.23	75.13
75.	40	Ann. Chim	6	0.19	75.32
76.	40	Z. Anal. Chem.	6	0.19	75.51
77.	40	Microchem. J.	6	0.19	75.70
78.	40	Journal Chem. Pharm. Soc.	6	0.19	75.89

79.	40	Biochem. Biophys. Res. Comm.	6	0.19	76.08
80.	40	Journal Chem. Ber.	6	0.19	76.27
81.	40	Inorg. Chem. Acta	6	0.19	76.46
82.	40	Orient Journal Chem.	6	0.19	76.65
83.	40	Indian Journal Technol	6	0.19	76.84
84.	40	Adv. Protein Chemist	6	0.19	76.30
85.	40	Acta Chem. Scand	6	0.19	77.22
86.	41	Journal Phys. Org. Chem.	5	0.16	77.38
87.	41	Lipids	5	0.16	77.54
88.	41	Journal Polymer Science	5	0.16	77.70
89.	41	Indian Journal Med. Res.	5	0.16	77.86
90.	41	Angew Chemistry	5	0.16	78.02
91.	41	Journal Chem. Edu.	5	0.16	78.18
92.	41	Chem. Anal	5	0.16	78.34
93.	41	Indian Journal Exp. Biol.	5	0.16	78.50
94.	41	Pharmazie	5	0.16	78.66
95.	41	Clin. Chem.	5	0.16	78.82
96.	41	Journal Chem. Tech. Biotech	.5	0.16	78.98
97.	42	Water Treatment	4	0.13	79.11
98.	42	Europ Journal Biochem.	4	0.13	79.24

99.	42	Journal Pharm. Pharmacol	4	0.13	79.37
100.	42	Mech. Age. Develop	4	0.13	79.50
101.	42	Journal Chem. Pharm. Soc.	4	0.13	79.63
102.	42	Electrochem. Acta	4	0.13	79.76
103.	42	Discussion Faraday Soc.	4	0.13	79.89
104.	42	Chem. Lett.	4	0.13	80.02
105.	42	Journal Electrochem. Soc.	4	0.13	80.15
106.	42	Journal Clin. Invest	4	0.13	80.28
107.	42	Journal Gen. Physiol	4	0.13	80.41
108.	42	Anal. Comm	4	0.13	80.54
109.	42	Journal Phy.	4	0.13	80.67
110.	42	Life Sci.	4	0.13	80.80
111.	42	Asian Journal Chem.	4	0.13	80.93
112.	42	Desalination	4	0.13	81.06
113.	43	Biophys. Chem.	3	0.09	81.15
114.	43	Journal Med. Chem.	3	0.09	81.24
115.	43	Journal Chem. Research	3	0.09	81.33
116.	43	Journal Coord. Chem.	3	0.09	81.42
117.	43	Journal Physiol	3	0.09	81.51
118.	43	Arch. Biochem.	3	0.09	81.60
119.	43	Acta Physio Scand	3	0.09	81.69
120.	43	Journal Forensic Science	3	0.09	81.78

121.	43	Adv. Inorg. Chem.	3	0.09	81.87
122.	43	Journal Am. Oil Chem. Soc.	3	0.09	81.96
123.	43	Annalen	3	0.09	82.05
124.	43	Monatsch	3	0.09	82.14
125.	43	Journal Genontol	3	0.09	82.23
126.	43	Lancet	3	0.09	82.32
127.	43	Alexandria Journal Pharm.	3	0.09	82.41
128.	43	Journal Phys. Soc.	3	0.09	82.50
129.	43	Ind. Journal Environment	3	0.09	82.59
130.	43	Radiochem. Acta	3	0.09	82.68
		Title with 1 and 2 citation	505	16.67	99.35
		Total Citation :	**3028**		

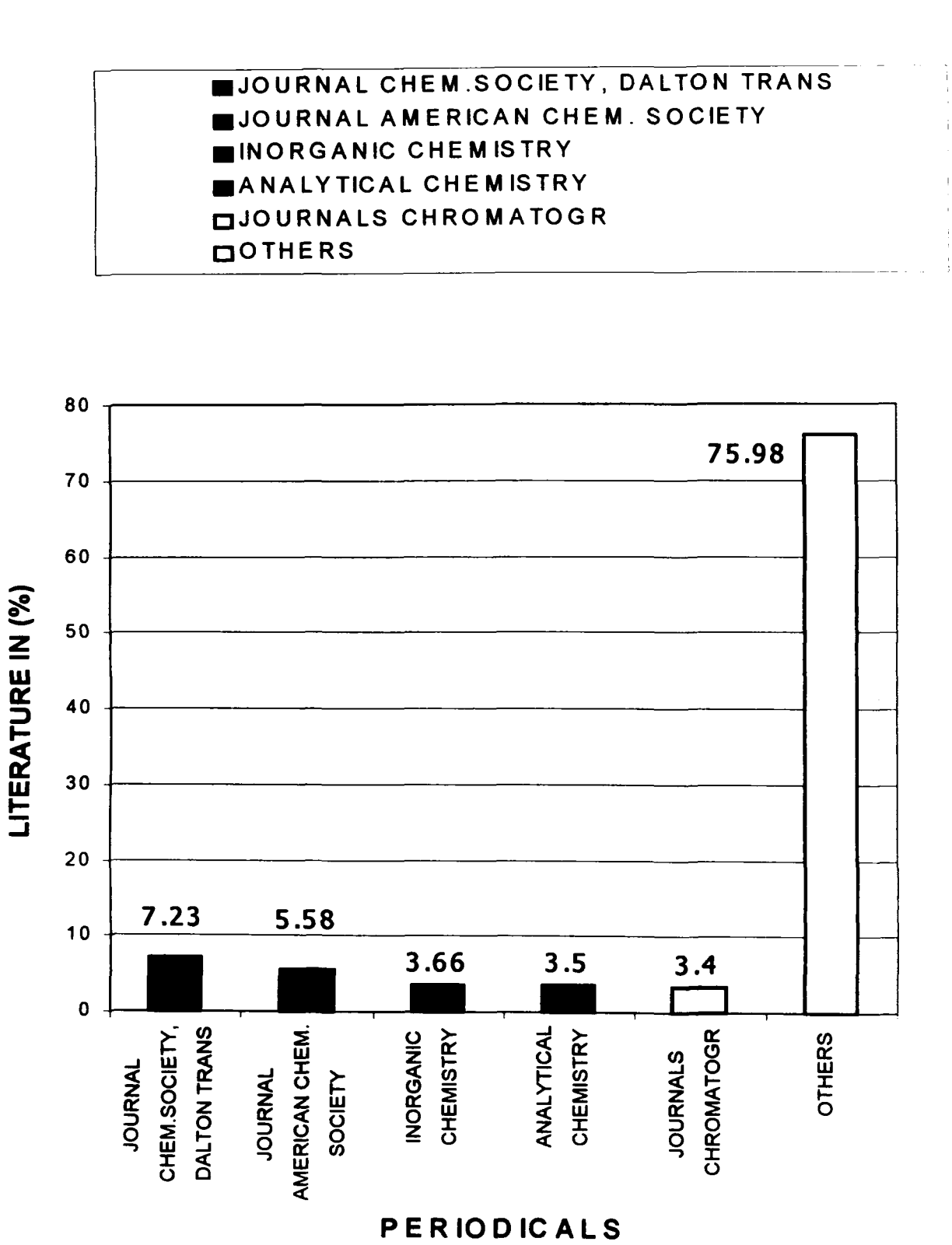

RANKING OF PERIODICALS
JOURNAL CHEM.SOCIETY, DALTON TRANS
JOURNAL AMERICAN CHEM. SOCIETY
INORGANIC CHEMISTRY
ANALYTICAL CHEMISTRY
JOURNALS CHROMATOGR
OTHERS
LITERATURE IN (%)
80
70
60
50
40
30
20
10
0
7.23
5.58
3.66
3.5
3.4
75.98
JOURNAL CHEM.SOCIETY, DALTON TRANS
JOURNAL AMERICAN CHEM. SOCIETY
INORGANIC CHEMISTRY
ANALYTICAL CHEMISTRY
JOURNALS CHROMATOGR
OTHERS
PERIODICALS

Figure 5.2

5.3 FORM WISE DISTRIBUTION

Information is available in a variety of forms i.e. Journal, Books, Conference, Symposium, Theses etc. The main objective of this study is to find out most used form of source material. It will help the researchers to know the most dominant forms of document in which information is being produced on the subject.

From Table 5.3 it is found that journals are the most dominant form in which information is communicated in chemistry. 80.96% literature on the subject appeared in the form of periodical article, Book and Bulletin consitute 9.99% and 2.88% and others are in the form of Reviews, proceedings, conference, patent, Ph.D. Theses, symposium, report, constitutes, 1.49%, 1.22%, 0.40%, 0.34%, 0.29%, 0.13%, 0.08%, 2.19% respectively.

TABLE 5.3

FORM WISE DISTRIBUTION

S.No.	Rank	Name of Forms	Frequency	Percentage of frequency	Cumulative percentage
1.	1	Journals	3028	80.96	80.96
2.	2	Books	374	9.99	90.95
3.	3	Bulletin	108	2.88	93.83
4.	4	Reviews	56	1.49	95.32
5.	5	Proceeding	46	1.22	96.54
6.	6	Conference	15	0.40	96.94
7.	7	Patent	13	0.34	97.28
8.	8	Ph.D. Thesis	11	0.29	97.57
9.	9	Symposium	5	0.13	97.70
10.	10	Reports	3	0.08	97.78
11.		Others	82	2.19	99.97
		Total	**3741**		

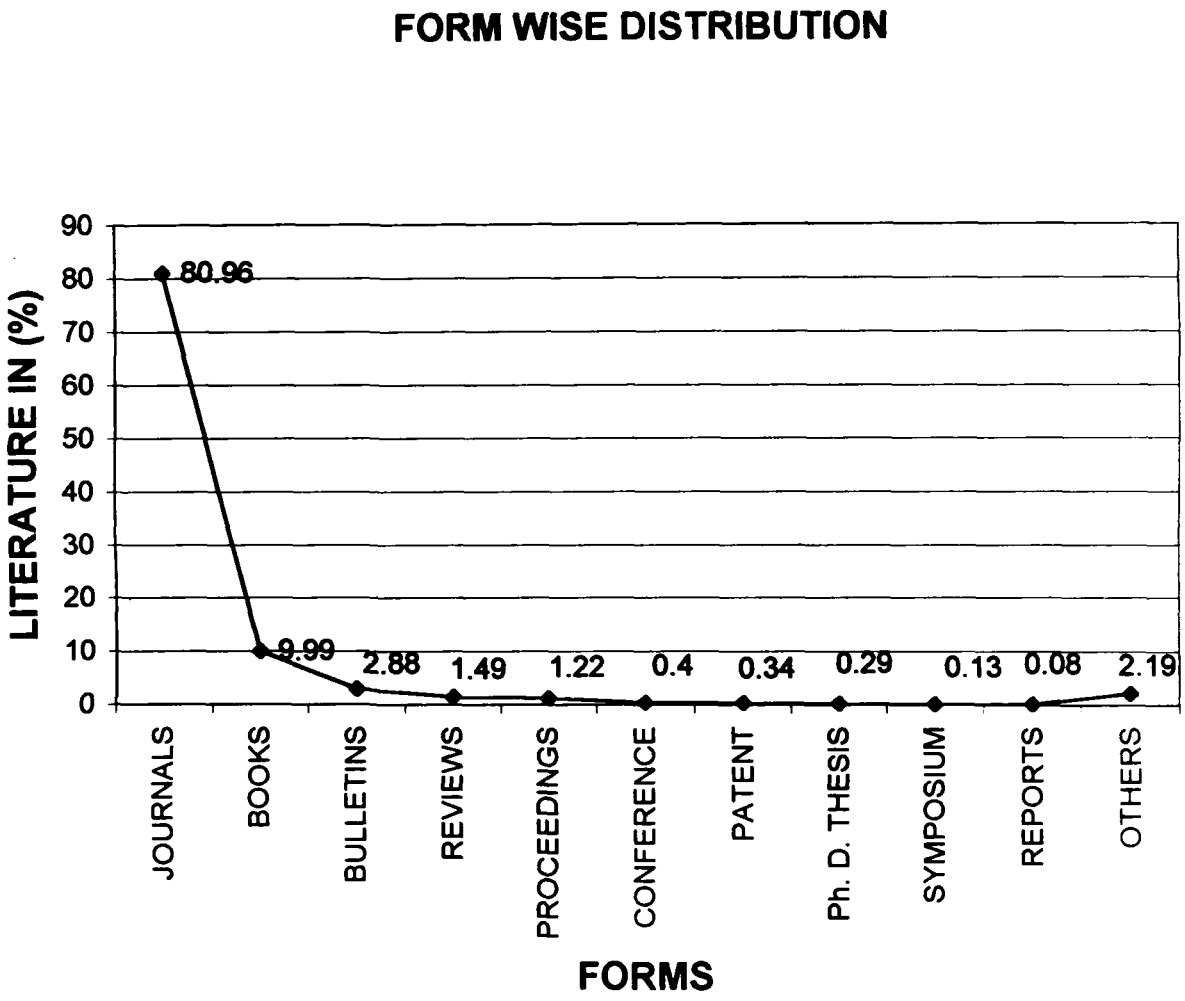

FORM WISE DISTRIBUTION
LITERATURE IN (%)
90
80
70
60
50
40
30
20
10
0
80.96
9.99
2.88
1.49
1.22
0.4
0.34
0.29
0.13
0.08
2.19
JOURNALS
BOOKS
BULLETINS
REVIEWS
PROCEEDINGS
CONFERENCE
PATENT
Ph. D. THESIS
SYMPOSIUM
REPORTS
OTHERS
FORMS

Figure 5.3

5.4 DECADEWISE DISTRIBUTION OF PERIODICALS

As mentioned earlier 16 dissertations submitted in the Chemistry Department in 1997 and 1998. This table shows the year wise distribution of papers published during the period of ten years.

According to the Table 5.4 it is observed that maximum number of journals were published during the period of 1981-1990 having 27.97% then comes the period from 1991-2000 have 26.61% and minimum number of journals appeared during the period from 1900-1910 having only 0.16%.

TABLE 5.4

DECADEWISE DISTRIBUTION OF PERIODICAL

S.No.	Rank	Period of Origin	Frequency of Occurrence	Percentage of Frequency	Cumulative % of Frequency
1.	1	1981-1990	847	27.97	27.97
2.	2	1991-2000	806	26.61	54.58
3.	3	1971-1980	605	19.98	74.56
4.	4	1961-1970	465	15.35	89.91
5.	5	1951-1960	135	4.45	94.36
6.	6	1941-1950	79	2.60	96.96
7.	7	1931-1940	65	2.14	99.10
8.	8	1921-1930	15	0.49	99.59
9.	8	1911-1920	6	0.19	99.78
10.	10	1900-1910	5	0.16	99.94
		Total:	**3028**		

DECADE WISE DISTRIBUTION OF PERIODICALS

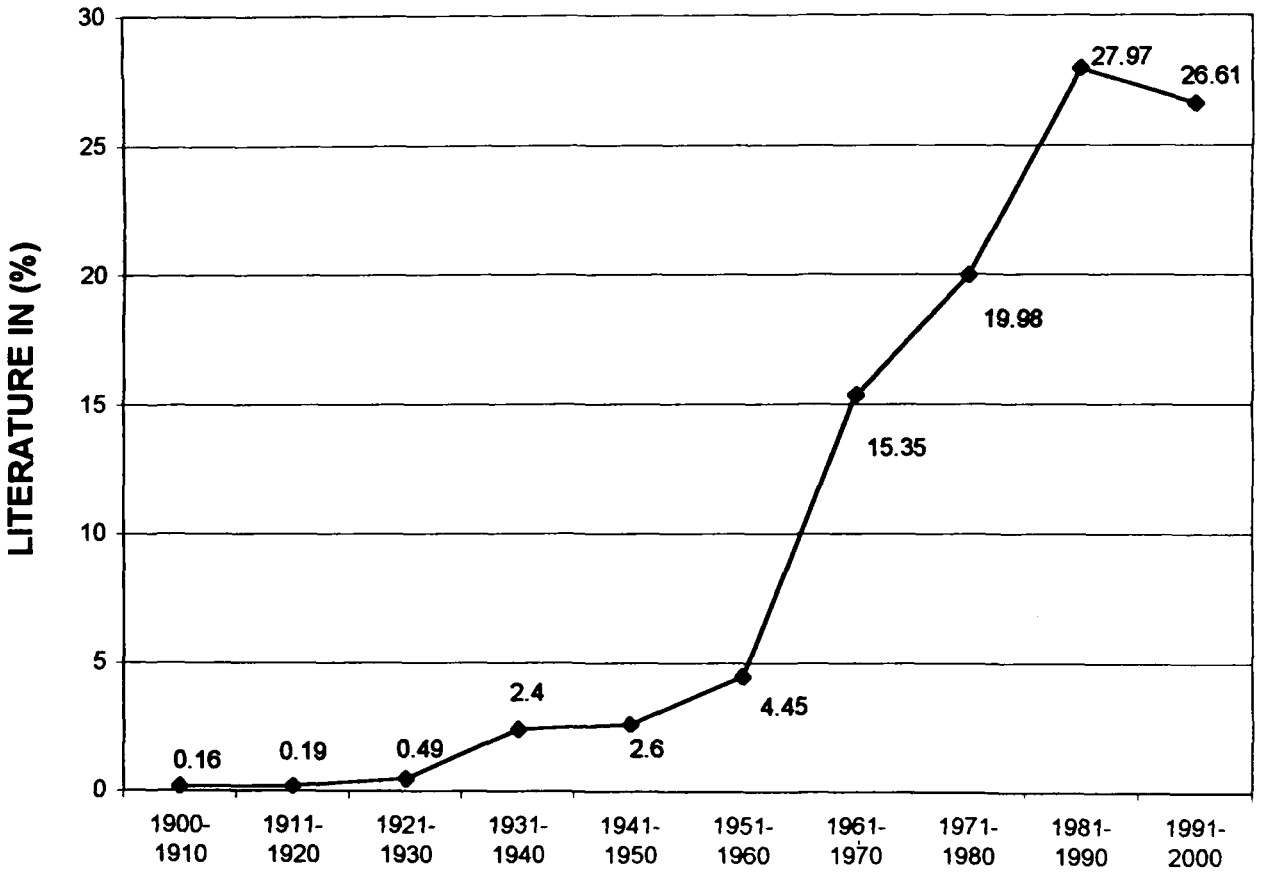
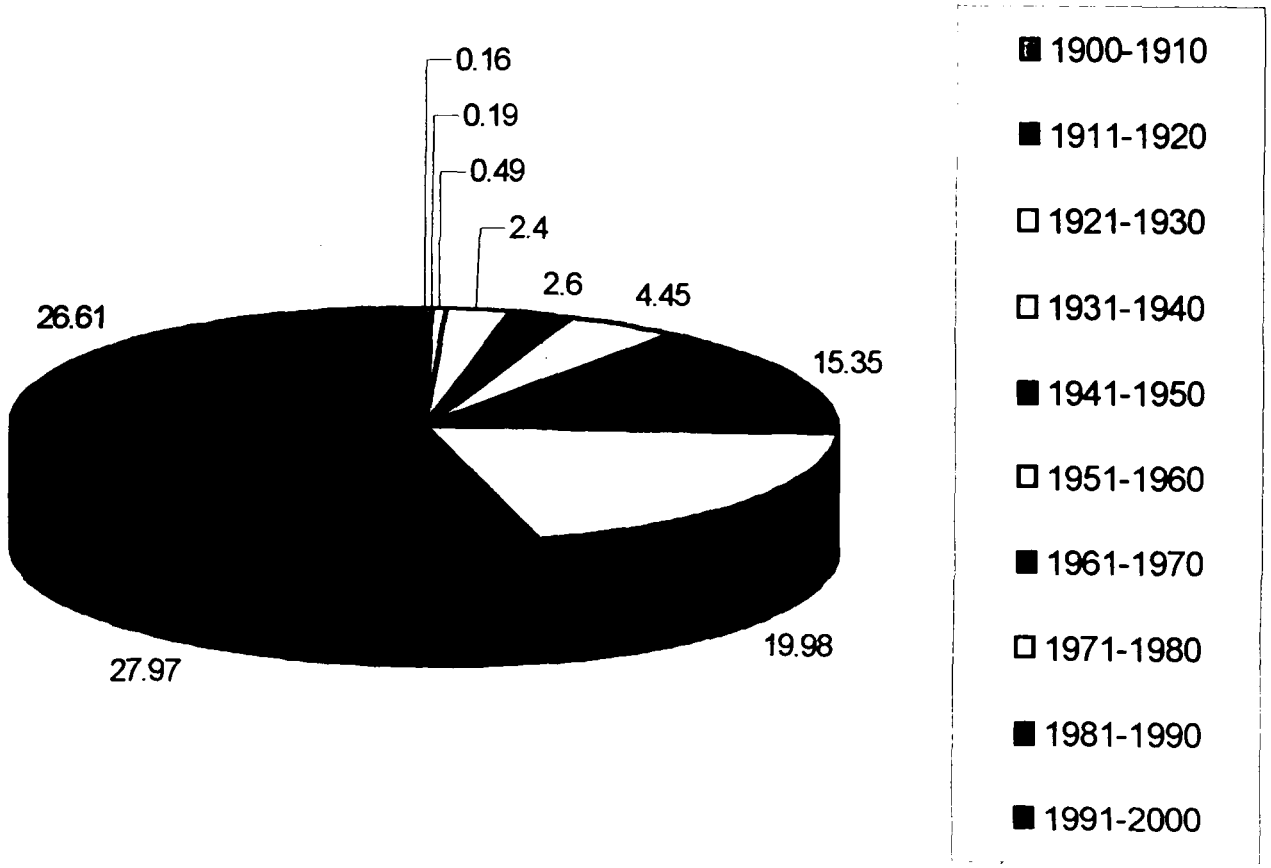


Figure 5.4



DECADE WISE DISTRIBUTION OF PERIODICALS

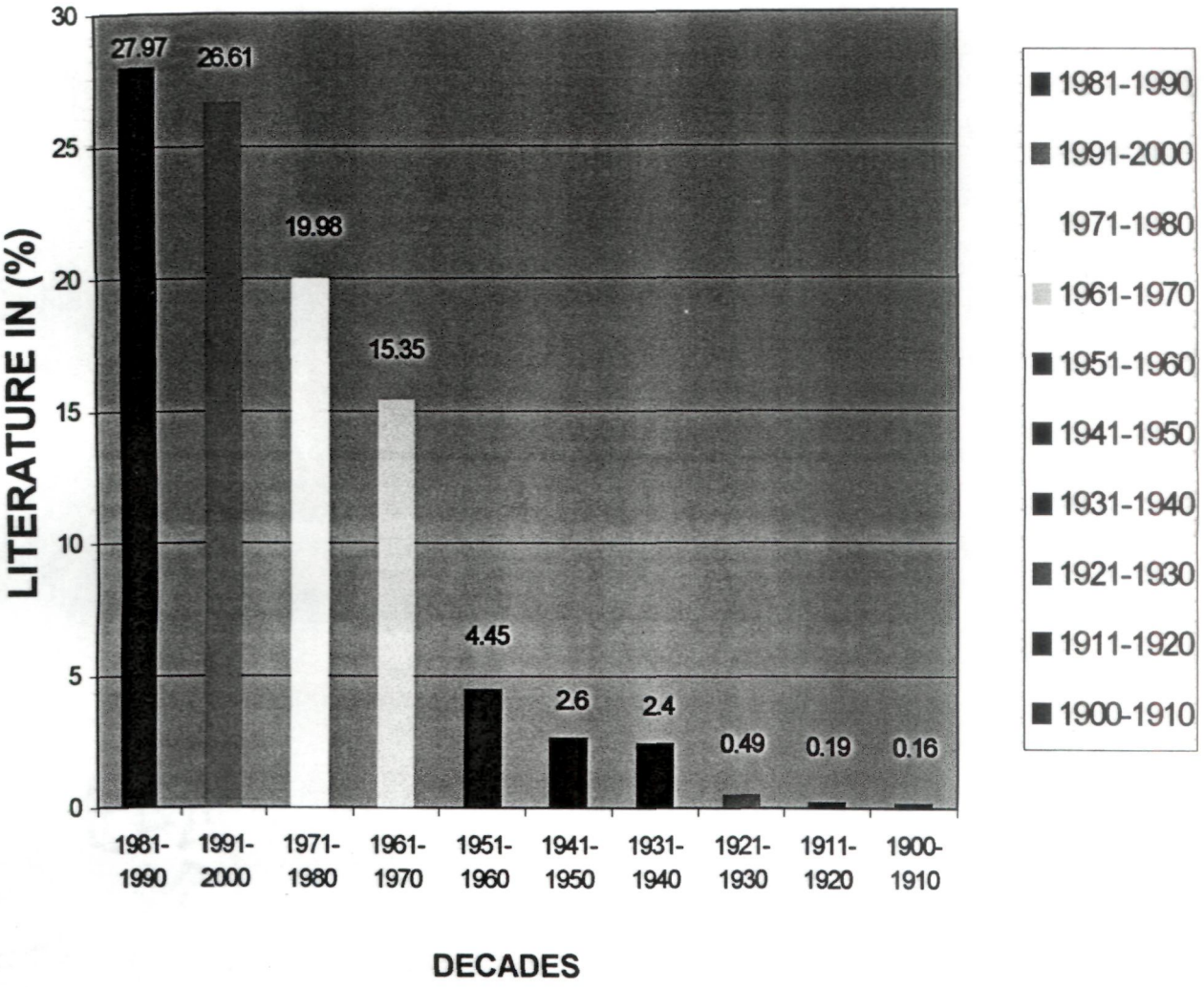


Figure 5.4

5.5 DECADEWISE DISTRIBUTION OF BOOKS

Table 5.5 shows the year wise distribution of books published during the period of ten years from 1900 to 2000.

According to the table it is observed that maximum number of books were published during the period of 1971-1980 having 30.74%, 1981-1990 having 24.59% and minimum number of books appeared during the period 1911-1920 having only 0.26%.

TABLE 5.5

DECADE WISE DISTRIBUTION OF BOOKS

S.No.	Rank	Period of Origin	Frequency of Occurrence	Percentage of Frequency	Cumulative % of Frequency
1.	1	1971-1980	115	30.74	30.74
2.	2	1981-1990	92	24.59	55.33
3.	3	1961-1970	85	22.72	78.05
4.	4	1991-2000	32	8.55	86.60
5.	5	1951-1960	31	8.28	94.88
6.	6	1941-1950	10	2.67	97.55
7.	7	1931-1940	5	1.33	98.88
8.	8	1911-1920	2	0.53	99.41
9.	9	1921-1930	1	0.26	99.67
10.	9	1900-1910	1	0.26	99.93
		Total :	**374**		

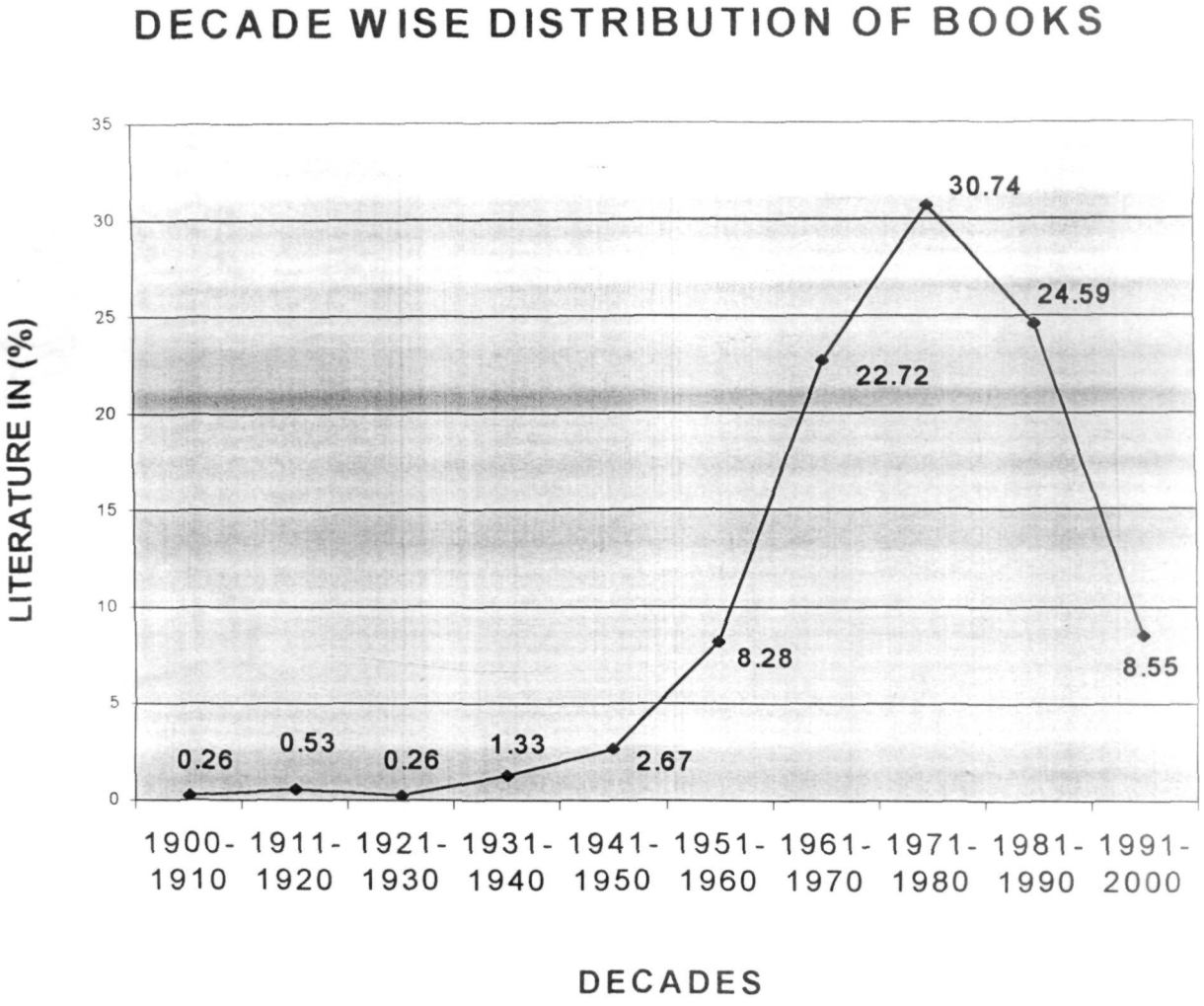
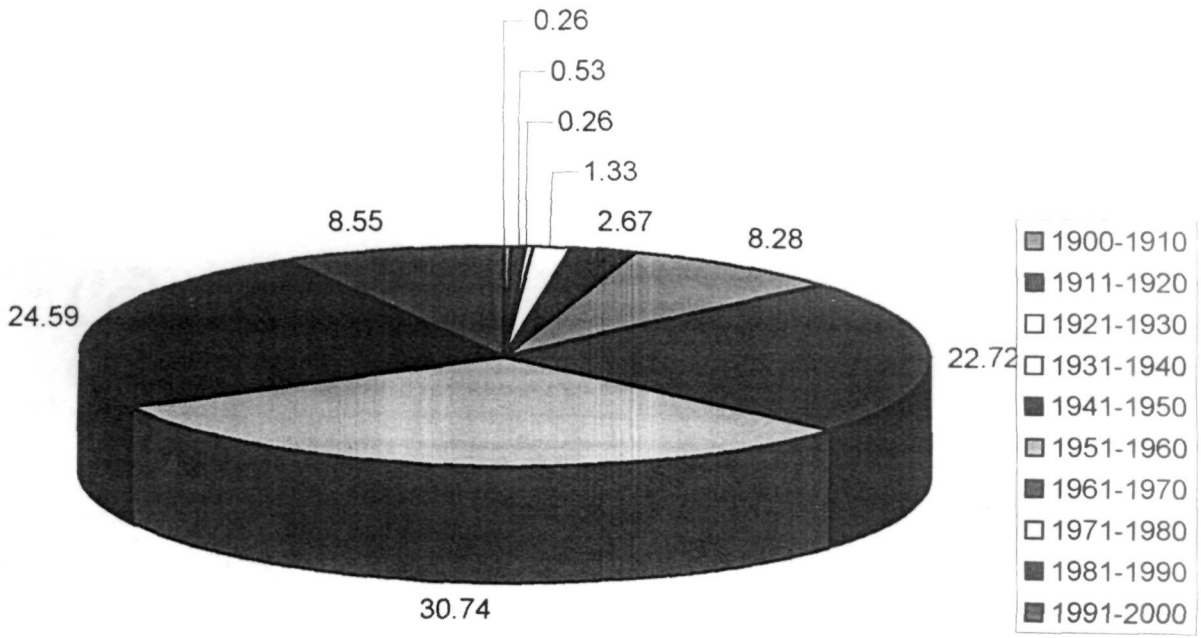

DECADE WISE DISTRIBUTION OF BOOKS
LITERATURE IN (%)
35
30
25
20
15
10
5
0
0.26
0.53
0.26
1.33
2.67
8.28
22.72
30.74
24.59
8.55
1900-1910
1911-1920
1921-1930
1931-1940
1941-1950
1951-1960
1961-1970
1971-1980
1981-1990
1991-2000
DECADES

Figure 5.5


0.26
0.53
0.26
1.33
2.67
8.28
22.72
30.74
24.59
8.55
1900-1910
1911-1920
1921-1930
1931-1940
1941-1950
1951-1960
1961-1970
1971-1980
1981-1990
1991-2000

5.6 DISTRIBUTION OF AUTHORS OF PERIODICALS (By number)

Table 5.6 shows the productivity of authors of journals. It is found that multiple authorship is more than the single authorship, only 550 journals were published by single author out of 3028 journals and remaining were published by multiple author.

TABLE 5.6

DISTRIBUTION OF AUTHORS OF PERIODICALS (By number)

S.No.	Rank	Number of Author	Frequency of Occurrence	Percentage of Frequency	Cumulative % of frequency
1.	1	Multiple Author	2478	81.83	81.83
2.	2	Single Author	550	18.16	99.99
		Total:	**3028**		

DISTRIBUTION OF AUTHORS OF PERIODICAL (BY NUMBER)

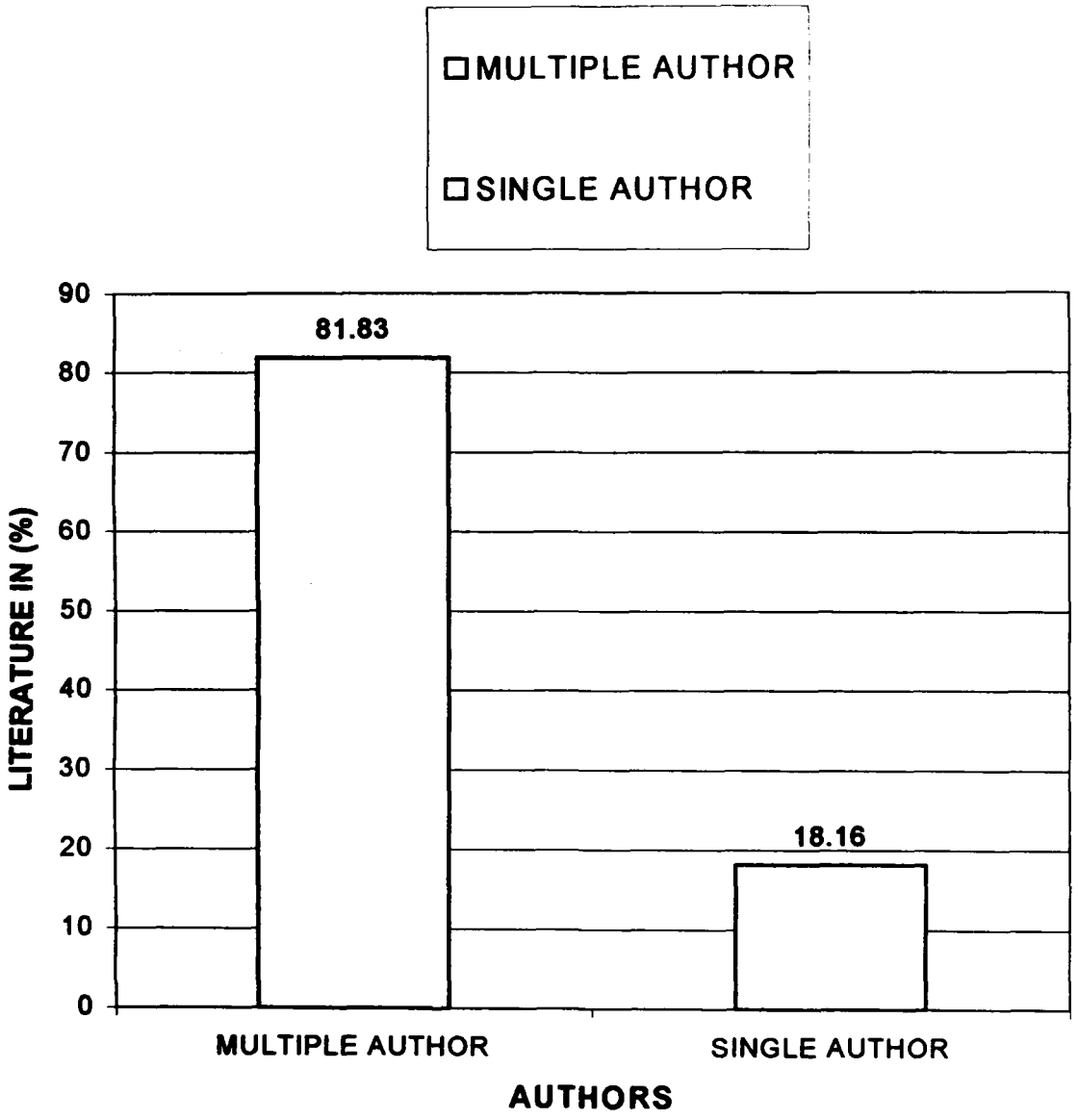


Figure 5.6

5.7 DISTRIBUTION OF AUTHORS OF BOOKS (By number)

Table 5.7 shows the productivity of authors of book. It is found that multiple authorship is more than the single authorship. Only 173 journals were found to have single authorship that of 374 books. The remaining books were contributed by multiple authors.

TABLE 5.7

DISTRIBUTION OF AUTHORS OF BOOKS (By number)

S.No.	Rank	Number of Author	Frequency of Occurrence	Percentage of Frequency	Cumulative percentage
1.	1	Multiple author	201	53.74	53.74
2.	2	Single author	173	46.25	99.99
		Total:	**374**		

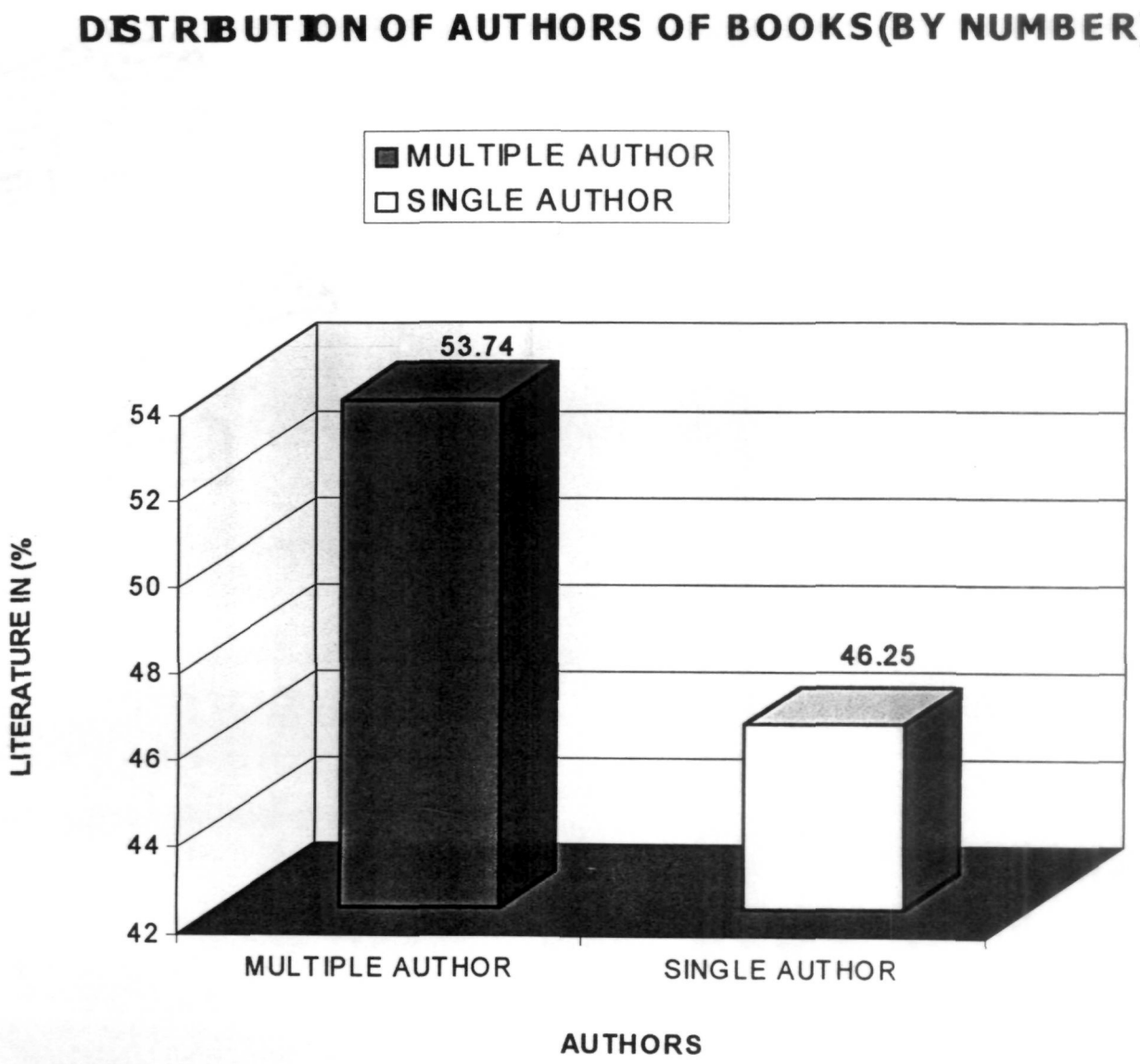

DISTRIBUTION OF AUTHORS OF BOOKS(BY NUMBER)
MULTIPLE AUTHOR
SINGLE AUTHOR
53.74
46.25
54
52
50
48
46
44
42
LITERATURE IN (%
MULTIPLE AUTHOR
SINGLE AUTHOR
AUTHORS

Figure 5.7

5.8 COUNTRYWISE DISTRIUBUTION OF JOURNALS

The country wise analysis of most cited publications indicates that out of 3028 citation, 970 (32.03%) are from U.S.A., followed by U.K. representing 821 citation (27.11%)

TABLE 5.8

COUNTRY WISE DISTRIBUTION OF JOURNALS

S.No.	Rank	Country	Frequency	Percentage of frequency	Cumulative %
1.	1	U.S.A.	970	32.03	32.03
2.	2	U.K.	821	27.11	59.14
3.	3	India	233	7.69	66.83
4.	4	Germany	179	5.91	72.74
5.	5	Japan	128	4.22	76.96
6.	6	Australia	103	3.40	80.36
7.	7	Brazil	93	3.07	83.43
8.	8	France	83	2.74	86.17
9.	9	Moscow	82	2.70	88.87
10.	10	Netherlands	74	2.44	91.31
11.	11	Sweden	71	2.34	93.65
12.	12	Spain	63	2.08	95.73
13.	13	Newzealand	27	0.89	96.62
14.	14	Algeria	21	0.69	97.31
15.	15	Italy	20	0.66	97.97
16.	16	Austria	18	0.59	98.56
17.	17	Poland	16	0.52	99.08
18.	18	Canada	14	0.46	99.54
19.	19	Switzerland	12	0.39	99.93
		Total	**3028**		

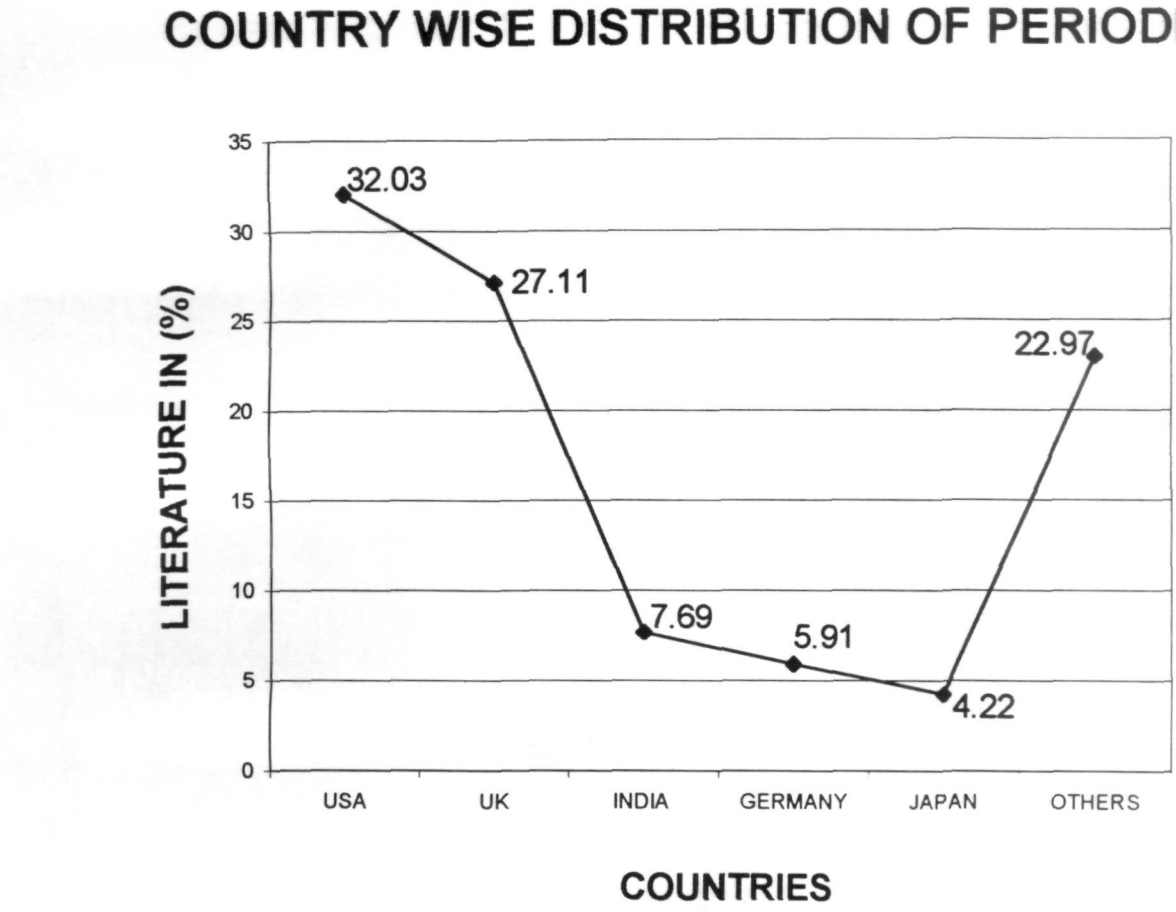
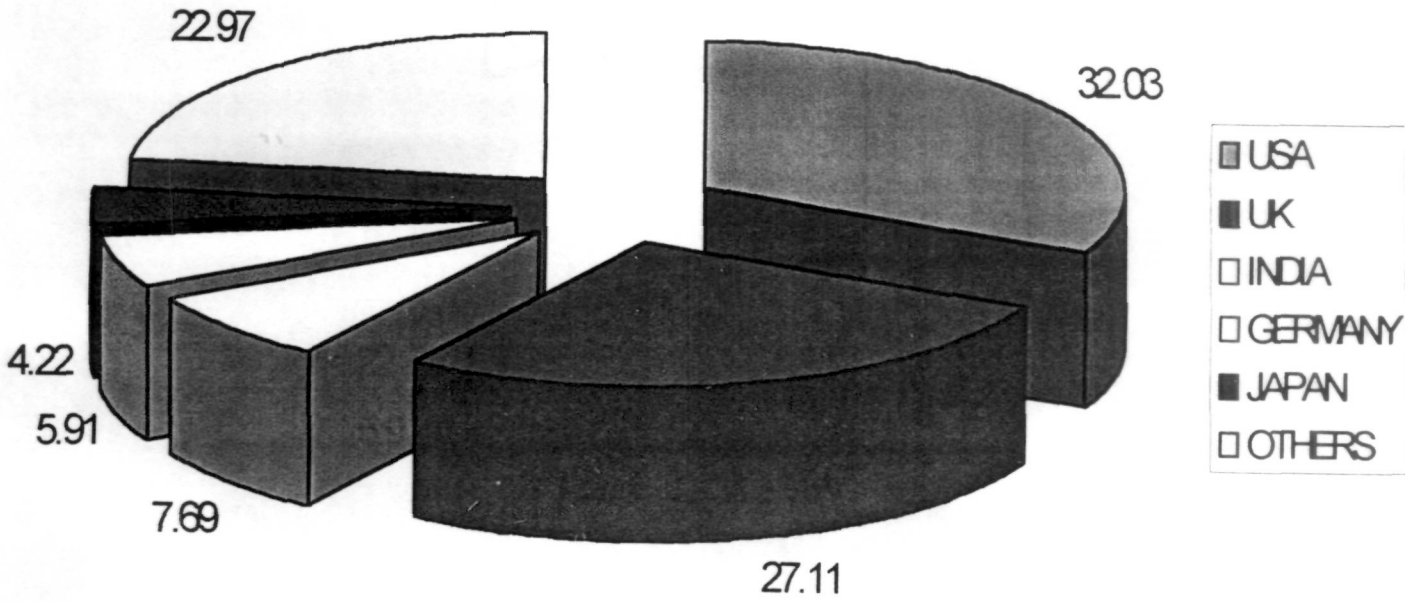

COUNTRY WISE DISTRIBUTION OF PERIODICALS
LITERATURE IN (%)
35
30
25
20
15
10
5
0
32.03
27.11
7.69
5.91
4.22
22.97
USA
UK
INDIA
GERMANY
JAPAN
OTHERS
COUNTRIES

Figure 5.8


22.97
32.03
4.22
5.91
7.69
27.11
USA
UK
INDIA
GERMANY
JAPAN
OTHERS

5.9 LANGUAGEWISE DISTRIBUTION OF PERIODICALS

The Table 5.9 shows that the literature used by the researchers were completely in English language.

S.No.	Rank	Language	Frequency	Percentage of frequency	Cumulative percentage
1.	1	English	3028	100	100

5.10 RANKING OF AUTHORS OF PERIODICALS

Ranking list of author's name indicates that M. Shakir and others occupied first rank which accounts for 46(15.19%) however table 5.9 lists frequency of author. There are only 611 (20.17%) authors whose names occurred twice and the rest 2417 (79.82%) occurred only once.

Table 5.10

Ranking of Authors of Periodicals

S. No.	Rank	Name of Author	Frequency
1	1	M. Shakir and others	46
2.	2	Rawat, J.P and others	22
3.	3	Drew, M.G.B and others	11
4.	4	Satio, T and others	9
5.	4	Siddiqui, F. A and others	9
6.	4	Walton, H.F. and others	9
7.	4	Yanjia, Lie and others	9
8.	4	Zang,L and others	9
9.	5	Fenton, D.E.	8
10	5	Fogg, A.G. and others	8
11.	5	Friendman, M and others	8
12.	5	Gliozzi, a and others	8
13.	5	Hirashima, C.F.	8
14.	5	Lear, I. D. and others	8
15.	5	Murillo, O and others	8
16.	5	Narebska, A	8
17.	5	Iurg, A and others	8

18.	6	Eisenman, g and others	7
19.	6	Ebdon. L and others	7
20.	6	Gekko, Knihiko and other	7
21.	6	Gundusharma, UM	7
22.	6	Kraayenlot, R and others	7
23.	6	Locan, P and others	7
24.	6	Nair, S.M and others	7
25.	6	Vishwanathan, S	7
26.	7	Abdulla, M.A.	6
27.	7	Akanni, A.O and others	6
28.	7	Beg, M.N. and others	6
29.	7	Brown, H.C. and others	6
30.	7	Bunton, CA	6
31.	7	Nath, M. and others	6
32.	7	Rao, M. Prasad and others	6
33.	7	Taihei Koseki and others	6
34.	7	Wairs, J.R and others	6
35.	8	Boyle, K.P.O. and others	4
36.	8	Busch, D.H. and others	4
37.	8	Cunninghan, D and others	4
38.	8	Everse, K.E.	4
39.	8	Parker, D and others	4
40	8	Rastogi, R.P and others	4
41	8	Tasaka, M and others	4
42.	8	Varshney, K.G. and others	4
43.	8	Verma, R.S. and others	4
44.	9	Bers, S.S. and others	3
45.	9	Blas, de and others	3

46.	9	Blohora, R.L and others	3
47.	9	Brajter, Krystyna and others	3
48.	9	Bu, X.H and others	3
49.	9	Camoanella, L and others	3
50.	9	Clarke, B. and others	3
51	9	De blas, and others	3
52.	9	Diamond, J.M. and others	3
53	9	Hosseini, M.W. and others	3
54.	9	Izquierdo, P. and others	3
55.	9	Labtore, R and others	3
56.	9	S.A. Nabi	3
57.	9	Sandblom, J and others	3
58.	9	Siddiqui, F.A. and others	3
59.	9	Somogyi, J	3
60.	9	Srivastava, S.K and others	3
61.	9	Sharma, J and others	3
62.	9	Shindter, O and others	3
63.	9	Sutdiffe, V.F. and others	3
64.	9	Spieglar, K.S.	3
65.	9	Shakoor, O and others	3
66.	9	Strikland, W. and others	3
67.	9	Sies, H	3
68.	9	Tanford, C.	3
69.	9	Tamaqaki, s and others	3
70.	9	Tokes, L and others	3
71.	9	Toyoshima, y and others	3
72.	9	Ulus, I. H.	3
73.	9	Ulus, K.	3

74.	9	Viver, H and others	3
75.	9	Verma, K.K. and others	3
76.	9	Wagnera, H and others	3
77	10	Addison, A.W.	2
78.	10	Albert, g and others	2
79.	10	Altria, K.O.	2
80.	10	Atherton, F.R and other	2
81.	10	Anandan, S and others	2
82.	10	Arkal, A.F. and others	2
83.	10	Bellamy, L.I.	2
84.	10	Belal, F. and others	2
85.	10	Beckmann, s and others	2
86.	10	Breyer, a. and others	2
87.	10	Nernard, L.	2
88.	10	Bagdri, A and others	2
89.	10	Booth, J. and others	2
90.	10	Brese, N.E. and others	2
91.	10	Bhattacherya, P.K. and others	2
92.	10	Boveg, F.A. and others	2
93.	10	Cooper, S.R and others	2
94.	10	Chaugh, S.N. and others	2
95.	10	Clarke, and others	2
96.	10	Chandra, R. and others	2
97.	10	Cranston, H.A. and others	2
98.	10	Csuros, Z. and others	2
99.	10	Chow, C.K. and others	2
100.	10	Chopra, R.N. and others	2
101.	10	Eccles, I.C.	2

102.	10	Evans M.B.	2
103.	10	Eyring, H and others	2
104.	10	El wality, A.F.M.	2
105.	10	Frischat, G.	2
106.	10	Frausto da Silva and others	2
107.	10	Fribbron, I.C. and others	2
108.	10	Fabrezzi, L and others	2
109.	10	Fedai, I and others	2
110.	10	Helfferich, F.	2
111.	10	Hoover, W.G. and others	2
112.	10	Hara, S and others	2
113.	10	House, D.A.	2
114.	10	Ham, M.T.	2
115.	10	Hamelt, L.P.	2
116.	10	Hasebe, Y. Sun and others	2
117.	10	Hao.,H. Sun and others	2
118.	10	Haung, Peng. Nian	2
119.	10	Hegde, chitranjan	2
120.	10	Hussan, S and others	2
121.	10	Halman, R.T.	2
122.	10	Heller, I.H. and others	2
123.	10	Hoover, I. M. and others	2
124.	10	Hofer, H.H. and others	2
125.	10	Malik, W.U and others	2
126.	10	Montero, S and others	2
127.	10	Micheelis, L and others	2
128.	10	Moore, S.	2
129.	10	Moore, S.	2

130.	10	Mishra, S.K. and others	2
131.	10	Miller, D.	2
132.	10	Mc. Caldin, D.S.	2
133.	10	Meister, A.	2
134.	10	Moats, W.A	2
135.	10	Muller, N.	2
136.	10	Moi, M.K. and others	2
137.	10	Mittal, H.S. and others	2
138.	10	Stricliffe and others	2
139.	10	Sutchffe and others.	2
140.	10	S.Z. Qureshi and others	2
141.	10	Stigler, D.	2
142.	10	Spedding, F.H. and others	2
143.	10	Suruki, H.	2
144.	10	Synder, L.R. and others	2
145.	10	Ting, S	2
146.	10	Teorell, T. and others	2
147.	10	Tabushi, I. and others	2
148.	10	Vessuran I.	2
149.	10	Van Bruggen I.T	2
150.	10	Vorlonder, d and others	2
151.	10	Villran, s. and others	2
152.	10	Vella ccio, f and others	2
153	10	Walton, H.F.	2
154.	10	Widersich, H.	2
155.	10	Wiltmann, H.	2
156.	10	Wolf, M.L. and others	2
157.	10	Wolters, R and others	2

158.	10	Wilkinson, G and others	2
159.	10	Wender, P.A.	2
160.	10	Weper, K	2
161.	10	Wills, E.D.	2
		Total	611
162.	11	Adam, K.R and others	
2866	11	Zurloye, H and others	Total 3028

Total no. of Journal-Multiple Authors = Single Authors

3028-611= 2417 (single Authors)

Chapter - 6

Finding of the study
And
Tenability of Hypotheses

6.1 FINDINGS OF THE STUDY

The following are the major findings of this study:

6.1.1 A rank list of journals, first 43 most cited journal with a minimum of 3 citation has been given; which accounts for 82.68% of total journal literature. The remaining 16.67% are contributed by as many as 505 journals. The 'Journal Chemical Society, Dalton Trans' occupied the first position with the highest number of citation 219 (7.23%).

6.1.2 The researchers in the field of chemistry mainly use journals, which have the highest number of citation, i.e. 80.96% of total references and Report have the minimum citation i.e. 0.08%.

6.1.3 The maximum number of dissertations are submitted by the researchers in "organic chemistry", which accounts for 06 (37.5%) among and the minimum dissertations are submitted in "Analytical Chemistry" i.e. 2 (12.5%).

6.1.4 The most productive country of journal is U.S.A. which have the highest number of citation, 970 (32.03%) followed by U.K. 821 (27.1%).

6.1.5 The most of the journals used by Research scholar, were taken from the period 1981-1990 which account for 847 (27.97%) and the minimum journals were taken from 1900-1910 which accounts for only 5 (0.16%)

6.1.6 The most of the books used by research scholar, were taken from the period 1971-1980 which accounts for 115 (30.74%) and the minimum books were taken from 1921-1930 and 1911-1920 which accounts for 1 (0.26%).

6.1.7 Rank list of authors name indicates that maximum articles were contributed by Mohd. Shakir & others, which accounts for 46

(1.51%). There are only 611 (20.17%) authors whose name occurred twice and the rest 2417 (79.82%) occurred only once.

6.2 TENABILITY OF HYPOTHESES

6.2.1 Hypothesis 1

The researchers in the field of chemistry are mainly consulting 'Journals'.

It is clear from the table 5.2 that the journal have the highest number of citation, accounting for 80.96% of total citation. Hence hypothesis proved.

6.2.2 Hypothesis 2

The frequency of multiple author is higher than single author.

The table 5.6 reveals that most of the documents 2478 (81.83%) produced by Nmultiple authors. Hence Hypothesis is proved

6.2.3 Hypothesis 3

The most cited journal is 'Journal Chemical society, Dalton Trans'.

The Table 5.2 reveals that the "Journal chemical Society, Dalton Trans" occupied the first position with the highest citation number 219 (7.23%). Hence Hypothesis is proved.

6.2.4 Hypothesis 4

The most productive country is U.S.A.

The Table 5.8 reveals that the U.S.A. occupied the first rank with highest frequency 970 (32.03%). Hence Hypothesis is proved.

6.2.5 Hypothesis 5

Most of the literature is published in English language.

The Table 5.9 reveals that the literature used by the researchers were completely in English language Hence Hypothesis is proved.

6.2.6 Hypothesis 6

In organic Chemistry most of Dissertations have been submitted.

The Table 5.1 reveals that from 1997-1998 most of the dissertations were submitted in 'Organic Chemistry' by the researchers which accounts for 6 (37.5%). Hence Hypothesis is proved.

6.2.7 Hypothesis 7

The most of the journals were taken from during 1981-1990 and books from during 1971-1980.

It is clear from Table 5.4 and 5.5 that most of the journals were taken from 1981-1990 which have the highest frequency 847 (27.97%) and most of the books were taken from 1971-1980 which have the highest frequency 115 (30.74%). Hence Hypothesis is proved.